United States Court of Appeals

for the Second Circuit

APPENDIX

75-7362

United States Court of Appeals
FOR THE SECOND CIRCUIT

B

Docket No. 75-7362

PERMA RESEARCH & DEVELOPMENT COMPANY,

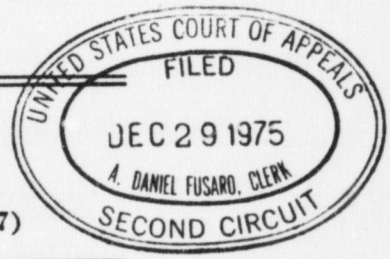
Plaintiff-Appellee,

—v.—

THE SINGER COMPANY,

Defendant-Appellant.

ON APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF NEW YORK



JOINT APPENDIX

VOLUME III (Pages A-668 through A-1086)
PORTIONS OF TRIAL TRANSCRIPT (pp. 3360-5387)

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All Exhibits are located in a Separate Exhibit Binder.

Q Did there come a time when you received a written report of Ford Motor Company's evaluation of the Perma device?

A Yes, there did.

Q Was this report prepared by the Ford Motor Company, to the best of your knowledge.

MR. GRAND: I object to it. I don't know how he could have any information on that.

THE COURT: I assume it came in a Ford envelope.

THE WITNESS: It came on Ford stationery.

THE COURT: All right.

Q I hand you Defendant's Exhibit 337 for identification and ask if you can identify it.

A Yes. This is an engineering report prepared by members of the Ford staff.

MR. GRAND: If he is just going to be reading from the document I am going to object to that.

THE COURT: No.

MR. GRAND: Ford's name does not appear on the front of this document.

THE COURT: Let him testify. Go ahead.

A It's dated March 23, 1966. The subject is "Singer anti-skid control unit." It was directed to a Mr. A. E. Samson.

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Q Are you aware of the conclusions of the Ford Motor Company with respect to the potential of the Perma device in its present state?

MR. GRAND: Objection.

THE COURT: Sustained. The potential?

MISS TAYLOR: Potential.

THE COURT: Sustained.

MR. GRAND: I really think we can just shortcut this by my saying on the record, your Honor, that this is two weeks after the date of the complaint, this Ford document.

MISS TAYLOR: As Mr. Romel's test report indicates, the date of the testing that at least he witnessed was March 7th, prior to the date of the complaint.

THE COURT: Yes, but Mr. Romel's report indicates that further tests are going to take place.

MISS TAYLOR: Your Honor, first I would like to offer Defendant's Exhibit 337 for identification in evidence, and, in view of Mr. Grand's objection, state that we believe this document is quite relevant to the case, despite its date at the top after the filing of Perma's complaint.

It's my believe that Ford's obviously negative evaluation of the Perma device, its conclusion that the device offers n. otential in its present state, its recommendation that further testing be discontinued, and so forth,

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go to, number 1, the issue of the marketability of the Perma device, which I believe is perhaps an issue, and secondly, to the question of damages or perhaps mitigation of damages.

In other words, if no one thinks this device is basically any good, Singer's ability to sell it or the actual value of the patents is shown by such a document.

MR. GRAND: Among the myriad of problems of getting into a document like this, your Honor, is one raised by a prior document we objected to, indicating that Ford and Kelsey-Hayes were at this time working on their own device.

I object to the document. It is a document presumably, according to this witness, prepared by people at Ford. If it's to come in it should come in through a Ford witness. But in no event should it come in. It's not relevant to any issue in this case. It's the rankest kind of hearsay.

As I say, it postdates the complaint. All decisions made by Singer had long since been made.

THE COURT: Objection sustained.

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BY MISS TAYLOR:

Q And to your knowledge did Ford Company recommend that further testing be discontinued on the Perma device?

MR. GRAND: Objection, your Honor.

THE COURT: When are you asking about? Ever?

MISS TAYLOR: Let's start with ever.

MR. GRAND: Your Honor, what she is trying to do, is get in some of the contents of the report which --

THE COURT: Was it ever done prior to January 26, 1966?

THE WITNESS: Not to my knowledge.

THE COURT: Okay.

Q Was it ever done, to your knowledge, prior to March 9, 1966?

MR. GRAND: Objection.

THE COURT: I don't care. Go ahead, answer it.

Q If you know.

MR. GRAND: May I, your Honor --

A My recollection is that --

MR. GRAND: May I, your Honor, inquire as to the possible relevance or probativeness of whether Ford recommended it to somebody?

THE COURT: It is faster to let him answer yes or no than to have the speech. Just let him answer.

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Go ahead.

A My recollection is that the tests which were conducted on March 7 led to the conclusions in this Defendant's Exhibit 337, that no further testing was warranted for development.

THE COURT: That is not the question before you.

Prior to -- was it March 9? Is that the date you used?

Prior to March 9 did they ever recommend that all testing be stopped?

MR. GRAND: Recommend to Ford, to Singer, to the world?

THE COURT: To Singer.

THE WITNESS: Did Ford ever recommend to Singer prior to March 9?

THE COURT: Yes.

THE WITNESS: No.

THE COURT: Okay.

Q Did there come a time prior to March 9, 1966, when Singer offered, under certain conditions, to return the patents to Perma?

A Yes.

Q What, if you recall, were the conditions of Singer's offer or offers?

MR. GRAND: I object to the form of that. We are going to have --

THE COURT: Did you have a conversation with someone in which this offer was made?

THE WITNESS: Yes, I did.

THE COURT: Who was the person?

THE WITNESS: With Mr. Perrino.

THE COURT: All right. Where did the conversation take place?

THE WITNESS: The first conversation took place at the Singer Company offices in New York City.

THE COURT: When did that happen?

THE WITNESS: There are some notes of that meeting, but I believe it was February 1, 1966.

THE COURT: All right. What did you say to Mr. Perrino and what did he say to you?

THE WITNESS: I don't recall all of the conditions of the offer. I remember the down payment part was $20,000 and we were willing to go on an installment basis.

THE COURT: Who's down payment? You were asking a down payment from Perma?

THE WITNESS: There are some notes of the meeting. May I look at those?

THE COURT: Do you have any recollection whatsoever

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about the meeting before you start looking at the notes?

THE WITNESS: All right. In the broadest sense, I said to Mr. Perrino that we have got to explore the possibility that his company would regain the rights, since he was still very much convinced about the marketability of the device, and said that I would like to suggest some terms as a trial balloon.

Very broadly, the terms were that there would be a downpayment of $20,000, and that we would value the inventory at below the value on our books, and that we would arrange any further payments based on his being successful. In broad scope that was the thrust of that.

THE COURT: Okay. That is all you can remember about the meeting then?

THE WITNESS: I am trying to think if there were other topics.

THE COURT: All right, let's shortcut it. Give the exhibit to the witness.

Q I will hand you Defendant's Exhibit 556 for identification and direct your attention to page 5 thereof and ask you if this refreshes your recollection as to any further [illegible] concerning the February 1, 1966 meeting about which you have not previously testified.

MR. BENDOW: I think it is 556 in evidence.

THE COURT: Is it in evidence?

MR. GRAND: No.

THE COURT: Go ahead.

A This does refresh my memory.

THE COURT: Tell me what else you remember now.

THE WITNESS: We placed a value of $600,000 on the inventory. Payment for that to Singer would be on the installment basis. The first installment would be only after Perma had sold a thousand units, so they would have some cash flow.

Perma said they would like Singer to warehouse the material for them, and there was no agreement reached on that point.

We would expect royalty payments that would eventually recoup for Singer the investment that we had to date.

Perma would be responsible for the retrieval of the units that had been sold to the Perma customers.

MR.GRAND: Could we get the amount, if his recollection is refreshed, on the amount that Singer was claiming its investment was to date?

THE WITNESS: I think I read that in.

THE COURT: No. How much did you say was the investment?

THE WITNESS: $2,000,000.

THE COURT: Okay, go ahead.

A And that there would be a full release by each party of any claims, one against the other.

THE COURT: Okay.

Q And when you said two million, did you mean two million or approximately two million?

MR. GRAND: I'm sorry, I didn't hear what you said.

(Question read.)

A The language in those notes is more than two million. It was in that ballpark.

THE COURT: Okay.

Q What was Mr. Perrino's response to Singer's offer at the meeting?

A His response was that he and his management people would think through this offer and that he and I would talk again on it.

Q Did there come a time when you had a subsequent meeting with Mr. Perrino concerning possible return under conditions of the patents to Perma?

A Yes.

THE COURT: When was that?

THE WITNESS: About two weeks later.

THE COURT: Okay. Where was it?

THE WITNESS: That meeting, as I recall, was in the

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Perma offices in North Attleboro, Massachusetts.

THE COURT: All right. Who was present, yourself and Mr. Perrino -- was there anybody else there?

THE WITNESS: Mr. Boriss from our company, some of the people from Perma, but I don't recollect.

THE COURT: You don't recall who they were, though?

THE WITNESS: No.

THE COURT: Okay.

There was a conversation between you and Frank Perrino and I guess Mr. Boriss might have gotten in it. Will you tell us who said what to whom?

THE WITNESS: I reiterated to Mr. Perrino essentially the terms that I have just testified to, but added to it, in the course of the discussion, that Singer would want to approve the sale of any Singer inventory to a third party. This approach had come up in our discussion.

Mr. Perrino wanted us to drop that requirement of settlement.

I explained to him that by approval Singer's interest was that if a new company was involved that it would be a company of financial substance.

Mr. Perrino responded that this was not an acceptable offer or set of conditions for Perma.

Q Were you advised that the piston O rings were the wrong size?

A No.

Q Were you advised that the check valve was not operating propertly?

MISS TAYLOR: Objection.

THE COURT: No.

A No.

Q Do you know what the check valve is?

A Yes.

Q What is it?

A It is a small ballshaped valve that isolates the brake pedal from the braking system when the Perma anti-skid unit goes into operation.

Q Did you ever ascertain the precise causes of the failure of the device to operate properly on that day?

A I was told that the device --

Q Can you answer my question?

A I am trying to answer it.

Q I think you can answer it yes or no.

THE COURT: Did you find out what the precise reason for the failure was, yes or not?

A Yes.

Q What were those reasons?

A The reason was the loss of vacuum because the engine stalled.

Q Who told you that?

A One of the Elizabeth personnel.

Q What is his name?

A I don't recall.

Q When was that told to you?

A Sometime after the run where the engine stalled.

Q That is, on the day of the test?

A Yes.

Q Before, I take it, anybody at Singer had an opportunity to take the unit apart and examine it?

A Yes.

Q Did the engine stall on all stops that you witnessed?

A No.

Q Did you learn the specific cause of what went wrong on the other demonstration?

A Yes.

Q When did you learn that?

A On the day of the test.

Q What was that?

A I believe what you just read is the first test run with the unit off, as indicated by the headlights being off, and it was to demonstrate what a panic stop would look like.

Q You're correct. Let's take the second run.

"A On the second run the car's headlights were on, to indicate to us the unit was on."

At line 21:

"A Again the brakes were applied, as indicated by the detonator going off. There were one or two violent pulsations and then there appeared to be no more pulsations. The wheels remained locked up. This was a more violent stop than the earlier one. The car swerved broadside and looked to me like it was going to tip over. It appeared to me something had gone wrong."

What did you learn was the cause of that?

A This second test run is the test run where I was informed that the engine had stalled, resulting in a loss of vacuum.

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to see Mr. diScipio that as a general rule you know how long after you requested to see him that you were allowed to see him?

MISS TAYLOR: Objection.

THE COURT: Sustained.

All right, he said relatively soon after. I don't know how much more you can tie it down.

Q In any event, when did you decide to recommend to diScipio not to accept or pursue the Cornell proposal? That is, did you decide it before you got the proposal, after you got the proposal?

A No, I made that decision after I got the proposal.

Q Did you make that decision immediately after you received the proposal?

A Same day.

Q Now, at your meeting on August 10 with Cornell, was there any discussion of computer simulation?

MISS TAYLOR: I object.

THE COURT: No, I will allow it.

Go ahead.

A I believe there was some discussion about the oscillograph, but I am vague as to what it was.

Q Let me show you a copy --

THE COURT: Look at page 2, paragraph 3.

evidence that does incorporate whatever the changes were.

Q Did you deliver to Mr. diScipio in the evening of November 9th the exhibit that we are talking about, Plaintiff's 99?

In other words, did you have that with you during the blackout when you were meeting with Mr. diScipio?

A I don't think so.

Q You had transmitted that to him earlier?

A This could have gone to him before the blackout.

Q Let's turn to the blackout and your meeting with him during the blackout. What time was the meeting with diScipio? Some time after the massive power failure?

A Some time after the lights went out. Right.

Q My recollection is about 5:17 in the afternoon. I don't know if anybody else has a recollection.

A 5:28 or something.

Q After five o'clock in the afternoon, in any event?

A Yes.

Q Did you convey to Mr. diScipio in that meeting the substance of both of the documents that make up Plaintiff's Exhibit 99?

A Yes, I did.

Q You recommended to him that Singer enter into

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a program of divestiture of the Perma program, did you not?

A Yes.

Q Did you also recommend that if it was impossible to divest, the Perma program should be written off.

A I don't believe that was the recommendation.

Q You don't believe it was? Let's take a look at page 3, again, of Plaintiff's 99, the page indicated as page 3. Under Reasons for Recommendations there is indicated some handwriting after the statement "Our recourse for recovery of investment from Perma is very limited"--I gather you can't read the handwriting any better than I can?

A That's correct.

Q Let me show you a copy, the exhibit number we are working on, of the final version of this memorandum, Exhibit 530 in evidence, under Reasons for Recommendations after the sentence I just read to you, it says "Should divestiture prove impossible, we would then recommend writing off the program."

Do you see that there?

A Yes.

Q Can you tell me if that is what that handwriting -- does it refresh your recollection that that's what the

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will call on you" had to do with the discussion of the technical services contract which, as I recall, Mr. Perrino wanted to continue, and it was in response to that discussion that I said in effect we did not want it to continue. "With regard to that relationship, we will call on you."

The other answer was in the discussion when Mr. Perrino said -- in effect chastised the Singer Company because he said the solution to the fail-safe problem was relatively easy, and that's where I said, "We would be more than delighted to see your suggestions."

Q When did the technical services contract expire?

A I don't know precisely.

Q Did it expire in June, 1965?

A I don't know.

Q By the time of the August 30 meeting, hadn't that contract expired approximately two months ago?

THE COURT: Two months prior.

A It may have, but I don't know.

Q Isn't it a fact that the technical services contract had nothing to do with the August 30 meeting?

MR. BENBOW: Couldn't hear it.

THE COURT: Keep your voice up. Read it back.

A Since January of 1973.

Q Have you ever been employed by The Singer Company?

A Yes.

Q What was your position immediately prior to leaving Singer, if you recall?

A Yes; I was group vice president and a director of the company.

Q When were you first employed by Singer?

A January 1963.

Q Prior to your employment by Singer or at Singer, by whom were you employed and in what capacity?

A By ITT, International Telephone and Telegraph Corporation, initially as vice president for marketing and commercial development and subsequently as president of the ITT Information Systems Division.

Q Are you familiar with what a feasibility study is, Mr. di Scipio?

A Generally, yes.

Q Prior to the summer of 1965, what was your title at Singer?

A At that time I was vice president in charge of the Consumer Products Division.

Q What were the responsibilities of the Consumer Products Divi[illegible]n prior to the summer of 1965?

A The Consumer Products Division was responsible for the marketing of the company's consumer products in the United States and Canada.

Q Prior to the summer of 1965 did the Consumer Products Division have any responsibilities in connection with the Perma anti-skid project?

A No.

Q Did there come a time, however, when the Consumer Products Division was merged with another division of The Singer Company?

A Yes.

Q And what was that other division?

A My former division, the Consumer Products Division, was merged with parts of two other divisions, a Research and Development Division and a Manufacturing Division.

Q And what name was given to this new division?

A We elected to use the same name, Consumer Products Division, for the new group as we had for the old.

Q Well, then, for clarity sake, maybe I can call -- and you will understand when I say and refer to the merged divisions as the new Consumer Products Division.

Did you personally occupy any position in the new Consumer Products Division?

A Yes. I was appointed vice president in charge of

the new Consumer Products Division.

Q When was the new Consumer Products Division formed, to the best of your recollection?

A As I recall, June of 1965 -- is that the year -- yes, 1965 .

Q Maybe just to tie that dow --

THE COURT: In June of '65 did you become responsible for the project that we call the Perma project?

THE WITNESS: Yes. I became responsible for the Manufacturing Division and that included as one of its projects the Perma device, not specifically that.

THE COURT: That is the only thing we are interested in here.

Q You seemed a little uncertain about the year, Mr. di Scipio. Does that remind you that it was June of '65?

A June '65, that's correct.

Q That is D-479, as we call it, Defendant's Exhibit 479 that you are looking at.

A Fine.

Q How and when did you first hear of the Perma anti-skid project, if you recall?

A I had first heard of the Perma project in the course of Singer's normal publicity when it was announced publicly--prior to the time that the new division was formed

THE COURT: Somewhat incestuous, yes, but I will still permit it.

THE WITNESS: I am going to have difficulty, your Honor, being responsive to that because I have an impression of what I gleaned from the presentation, but who made it and who said what I really have difficulty with.

MR. DeRENSIS: I renew my objection now that we are talking about impressions.

THE COURT: If we are just going into impression, that is not enough.

THE WITNESS: Could you perhaps give me a different question?

MR. BENBOW: Yes.

Q Was this a typical management briefing?

A Yes.

Q And I gather it didn't get into the details of the workings of the device?

A Not at all.

Q What was the status of product development of the project as of late June 1965?

MR. DeRENSIS: I object to that, your Honor, because there is no foundation, what the basis of his knowledge was.

THE COURT: We will get to it. What was the

status?

THE WITNESS: I don't know. As of that time, I don't know. I did not have that information.

Q Was development work continuing on the project, if you know?

MR. DeRENSIS: I object.

THE COURT: If he knows.

A Yes, very much an on-going project.

Q Was that the thrust of the presentation made to you?

A Yes.

THE COURT: All right, go ahead.

Q Did you believe it was an active on-going development project?

THE COURT: I don't care what he believed.

Sustained.

Q What happened at the conclusion of this initial presentation?

A It was agreed that the meeting would be adjourned while most if not all of us -- I don't believe everyone in the meeting went, but most of us were asked to go to a site of the New Jersey State Highway that had been completed, but not yet opened to public traffic, to witness a demonstration of the Perma device.

Liljw 1 di Scipio-direct

Q Did you personally personally go to this unopened section of highway?

A Yes.

Q Was it to be used as a test track?

A Yes.

Q How many lanes were available, if you recall, for the demonstration?

A It was a divided highway. I believe two lanes in each direction, and my recollection is that two lanes were available for the test.

Q Had anything been done to this section of highway to prepare it for the demonstration?

A Yes. It had been wet down or otherwise --

THE COURT: It looked wet to you?

THE WITNESS: Yes.

Q Was it slick?

A Yes.

Q Can you recall the make and model of the test automobile?

A It was a late model Cadillac, as I recall.

Q By that, of course, you mean late model as of the year 1965?

A Yes.

Q Do you remember its color, by any chance?

THE COURT: I will sustain that. Eventually the car went down the other end of the test track, right?

THE WITNESS: Yes.

THE COURT: I gather you were standing there watching?

THE WITNESS: Yes.

THE COURT: Tell us what happened.

THE WITNESS: Well, on the first run with the device not engaged, the car came down the stretch of highway, the brakes were applied and I have a strong recollection that the car went into a fairly violent skid, turned partially sideways, went off on to the center divider, and I have -- I remember being very concerned that it was going to turn over, but it didn't. It came to a stop off the highway.

Subsequently the car returned to the beginning point. The headlights were turned on, which we had been told meant the device was engaged. The car came down the stretch of highway, the brakes were applied and instead of what I had thought was going to happen, namely a --

MR. DE RENSIS: I object to what he thought.

THE COURT: I don't care about what you

thought. Just tell us what happened.

THE WITNESS: The car again went into a skid. It did not skid as far or as violently as before, but it did turn side-- definitely went into a sideways type of skid, proceeded past the point that had been indicated for stopping and I remember that was of some concern.

I turned to some of my associates, asked what had happened. No one seemed to have an explanation. They said that -- we joked about the facts, I think --

MR. DE RENSIS: Your Honor.

THE COURT: No, no, I will permit it. It is conversation that was part of it.

THE WITNESS: That those of us who had ever been associated with engineering projects are familiar with a pattern that you run a test many times successfully and you finally bring the boss in to see it, and then when you run the same test in the same way, something doesn't work. So we all agreed that we would try it again.

Either before that second run -- my strongest impression of that whole day is what happened on the next run. The rubber cones, the kind -- those triangular cones that are used when you ~~paint~~ paint a line, three of them

MR. DE MENSIS: I object to the conversation.

THE COURT: I will permit it. Go ahead.

THE WITNESS: And said, "Look, that device didn't operate the way I had understood it would, and I think we better go back and have some conversations about what's going on here."

THE COURT: So you went back?

THE WITNESS: So we went back. Not everyone who had been at the test site -- I don't believe Romel and Kloby came back with us, the two fellows who were driving the car, but Murphy and Broeker and my New York staff went back to the Elizabeth factory and we reconvened in the conference room.

I indicated -- I stated that it had been my impression that a product had been developed and was operational and that was going to be demonstrated, and it had not been demonstrated successfully, and I wanted to know why, what had happened, what had gone wrong. There were not at that meeting at that time any explanations forthcoming. There were some statements, "Well, we are not sure what went wrong, we will have to look into it."

I was not prepared, because of the magnitude of the project to let it drop at that, and I began to

to the operator" and I finally extracted the fact that that was not the case.

THE COURT: Who said it?

THE WITNESS: It would have had to have been either Murphy or Broeker, I believe. I don't recall specifically, your Honor. It was a rather emotional meeting.

THE COURT: Murphy and Broeker were not the technical people on this device, on the program?

THE WITNESS: Right. They were part of the manufacturing operation.

THE COURT: They weren't the engineers actually working on the program, were they?

THE WITNESS: No.

BY MR. BENBOW:

Q Just to interject, were both Messrs. Murphy and Broeker engineers, if you know?

A I know Murphy was because I recall he went to MIT. Broeker's specific education, I don't know, but all of our manufacturing people had strong technical backgrounds.

MR. DE RENSIS: I move to strike that.

THE COURT: Come on. Go ahead.

THE WITNESS: We really concluded on that

point. I made the statement that I couldn't conceive that a company like The Singer Company could market any device that was advertised and marked as a safety device that under any circumstance could leave the purchaser of that device less safe than if he hadn't elected to purchase it, and I made it clear to everyone that as far as I was concerned, that was a most serious consideration and one that would go to the whole availability of the project, and that we would have to have further discussions and activities along this line.

THE COURT: The meeting then concluded, right?

THE WITNESS: Yes.

MR. BENBOW: If I may, your Honor.

BY MR. BENBOW:

Q Before it concluded, did you direct that fail-safe be given a certain priority in that meeting?

A I am quite certain at that meeting, I don't remember the line which I used, but I do recall making the point, which is a paraphrase of what I just said, that I did not believe it was appropriate for Singer to market a safety device unless the failure of that device as a minimum left the consumer no less safe than had he

judgment as to acceptable fail-safe probabilities at that time?

MR. DE RENSIS: Your Honor, I object to that.

THE COURT: I don't know what "that time" is.

MR. BENBOW: November, 1965.

MR. DE RENSIS: We don't know who Singer is.

THE COURT: Somebody had to do it. Did you do it, Mr. di Scipio?

THE WITNESS: Would you restate the question? I lost it in the course of the exchange.

Q I apologize, Mr. di Scopio. Let me try again.

Did Singer sit down --

THE COURT: No, not "Singer." Did you make a decision in November of 1965 that this thing was technically not feasible and would not meet your requirements?

THE WITNESS: No, we did not.

Q Just so we are clear on this, I think his Honor's question intended to cover it, but, if not, let me ask it to you again, Mr. di Scipio. Are you

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PERMA RESEARCH & DEVELOPMENT COMPANY,

-v- 66 Civ. 665

THE SINGER COMPANY

April 25, 1974
10:25 a. m.

(In open court.)

MR. BENBOW: I have one preliminary matter, your Honor. I would like to make an offer of proof of what I have had premarked as Defendant's 656 for identification. Defendant's 656 for identification consists of two parts. The first is a letter agreement between Frank A. Perrino and The Singer Company dated December 21, 1964, executed by both parties.

MR. GRAND: Do I have a copy of this?

MR. BENBOW: I would be glad to give you one, Mr. Grand. The second part of it consists of a signed copy of what has come to be known as the technical services contract, I believe, also dated the 21st Day of December, 1964.

I offer it at this time, your Honor, because of some confusion which occurred under recross-examination of Mr. Person yesterday at pages 3578 and following of the transcript, and I think that this document read in connection

with Plaintiff's Exhibit 92, the first paragraph on page 2 to which Mr. Grand referred Mr. Person on that recross-examination, that the confusion which existed comes entirely clarified.

THE COURT: Do you want to get your witness? I will rule on it after --

MR. GRAND: May I just ask, your Honor, I guess I am not called upon to comment on the lack of confusion in the transcript. I gather that at least some portion of this document is already in evidence.

MR. BENBOW: No portion of the document is in evidence in this form, your Honor.

MR. GRAND: Is the agreement that is attached to the letter --

MR. BENBOW: Could I complete my sentence, Mr. Grand? The technical services contract, I believe, has been offered by plaintiff in an unsigned copy, and I thought it would facilitate his request previously made to have a signed copy of that, which I am providing, and attached to it I find this letter agreement of December 21, 1964, part of Defendant's 656, the agreement between Mr. Perrino and The Singer Company.

MR. GRAND: I notice that the second page of the letter has a "/s/" next to a signature and the name of Frank Perrino. I assume that that is not Frank Perrino's signature.

I think that before the Court receives the document, I ought to at least have the opportunity to find out if it is authentic, your Honor. I have never seen it before.

THE COURT: Okay. I am reserving on it. You ought to have a chance to read it, too.

1-2

- - -

ANDRE LEONARD DeVILLIERS,

having been previously duly sworn, testified further as follows:

THE COURT: Mr. DeVilliers, sometime ago, prior to taking a break in your testimony, you were sworn. That oath to tell the truth remains in effect.

CROSS-EXAMINATION (CONTINUED)

BY MR. LAGEMANN:

Q Mr. DeVilliers, what was the threshhold of activation used in your computer simulations of the Perman Anti-Skid Device.

A .92 G.

Q How did you arrive at a threshhold of .92 G for a threshhold of activation?

A I arrived at, if we use the word threshhold, it is not my word --

Q What is your word, then? What does .92 G represent?

A To me .92 G signifies roughly the value of wheel

deceleration, expressed in terms of vehicle deceleration, that the micro switch would be triggered and that the system would be therefore activated and --

Q Is that the wheel deceleration which is required in order to arm the Perma Anti-Skid Device, as you see it?

A Yes, basically that is -- I would say. However, I think that the nature of the system is such that there might be cases in which it might arm with less.

Q Might there be cases where it would take more --

MR. DeRENSIS: Your Honor, could he finish his answer before he is interrupted?

THE COURT: Yes.

A Principally I will live with the value of .92 G's, and in answer to your question as to how I got it --

Q Let me interrupt you because I think you are going beyond. Let me ask the question I just asked you, which is might there be circumstances or instances in which it would take more than .92 G to arm the Perma Anti-Skid Device?

A As a matter of fact, I believe that that would be about the maximum.

Q Where did you obtain the data required to compute the .92 G figure?

A I used --

Q The question is where, sir, did you obtain it.

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A I obtained that from the law firm of Poletti, Freidin.

Q What did they provide you with that you used to obtain the .92 G figure?

A I asked them.

Q I didn't ask you what you asked them. I said what did they give you.

A They provided me with engineering drawings of certain components which were given --

Q How many drawings, sir, and of what components did the drawings depict?

A I would have looked at a drawing -- I would have looked at a drawing that had the cam gear on it, I would have looked at drawings which had the small weights, the governor weights on it, the governor linkage, and I would have looked at -- in fact I did look at -- I say I would have looked in the sense that I did look at drawings which depicted the performance of the microswitch.

Q What drawings depicted the performance of the microswitch?

A I can't remember specifically the number or name of the drawing, but it is a drawing that had the microswitch.

MR. LAGEMANN: 23.

Q Mr. DeVilliers, I am handing you Plaintiff's Exhibit

23, which as we have discussed many times in the course of this litigation contains various drawings. Let me ask you, Mr. De Villiers, did you review Plaintiff's Exhibit 23 prior to making your computer simulations?

A I reviewed the parts of it that had information that I needed.

Q When did you review the drawings in Plaintiff's Exhibit 23 for the first time?

A This would have been last fall sometime, early last fall.

Q How early? What's the month?

A This is just an estimate, but I would say August or September.

Q Try to recall, Mr. De Villiers. Was it August or was it September?

MR. DeRENSIS: Asked and answered, your Honor.

THE COURT: It is necessary for some follow up question, that you know which, whether it was August or September?

MR. LAGEMANN: Yes, your Honor, it is.

THE COURT: All right. Can you figure out whether it was August or September? If you can't, say so.

A It probably was during both times, because I looked these drawings a number of times, and I am quite sure that I

looked at them during both of those months.

Q The question is when did you first look at the drawings.

A I think it was August, but I am not positive of that. I rather hedge it to September, but if somebody wants to go back, all right, August.

Q When you first looked at the drawings in Plaintiff's Exhibit 23, did you encounter a drawing of the cam gear?

A I am not absolutely sure. I think I --

THE COURT: If you are not sure, say so.

Q It is a simple yes or no question.

THE COURT: No. If you are not sure, say so.

A I am not sure that I looked at it the first time. I am sure I encountered the drawing, but whether I dealt with it at that point I don't remember. I don't think I did at the very beginning.

Q Did you say, sir, that you are sure you encountered the drawing?

A Reasonably. I mean encounter the drawing in the sense of a pile like this was on the desk in front of me, and I went through them looking for drawings that had information that I decided that I needed at that time.

Q Did you obtain the drawings in Plaintiff's Exhibit 23 from Plaintiff's counsel?

A Yes, I did.

Q Did you review them at plaintiff's counsel's office?

A I reviewed some of them at his office and I took some of them home with me.

Q Was your first encounter with these drawings at plaintiff's counsel's office?

MR. DeRENSIS: Your Honor, I object on the grounds of relevancy. I don't know what we are getting at.

THE COURT: I don't know where it is going either.

MR. LAGEMANN: That will become I think clear, your Honor, in avery short time.

A My first significant encounter was definitely at plaintiff's office, but if you really want to pin this down, I actually visited Mr. Perrino's home very early in my association. It might have even been a month or two earlier than all of that, and I can't remember, but I might have looked at them in his offices then, but not with the same thing in mind.

Q When you reviewed the drawings in Plaintiff's Exhibit 23 in plaintiff's counsel's office, did you encounter a drawing of the cam gear at that time?

A I think so, but I am not sure. I mean, I was exploring this device. To me hardware is much more important than drawings, anyway, because that is what the thing actually is. The drawing, somebody draws on a piece of paper and says this is what they want somebody to make for them, so I look at the hardware, and why I wanted the drawing was to get numbers that I couldn't get off of the hardware directly.

Q Did you take numbers off the cam gear drawing of when you first encountered Plaintiff's Exhibit 23 in Plaintiff's counsel's office?

MR. GRAND: I object because the witness hasn't said he first encountered that drawing in plaintiff's counsel's office. He said he might have encountered it in Mr. Perrino's office.

Q I am talking about the instance when you were in plaintiff's counsel's office and reviewed the documents in Plaintiff's Exhibit 23.

A Yes, I am almost losing your question myself, but this is what I think I am answering. In plaintiff's counsel's office I looked at the drawings, particularly when I knew what I wanted from them, which is very early, like last fall, early

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last fall, about September -- I think it may have been September that I actually seriously looked at them, you know, after some reflection. I knew at that point what I wanted off those drawings. I looked at those drawings. I sought those numbers. I sat and calculated on paper and many of the numbers that we ultimately came up with we discussed in direct testimony.

Q Did you make any calculations on paper based on the cam gear when you were in plaintiff's counsel's office on the occasion that you first reviewed the documents in Plaintiff's Exhibit 23?

A I believe --

MR. DeRENSIS: I object to that, your Honor, because we have no foundation laid that he saw this at plaintiff's counsel's office for the first time.

THE COURT: He said he didn't know whether he did or not. I am still wondering where we are going.

MR. DeRENSIS: I further object because I don't see the relevance of any of this.

THE COURT: I don't either, but it has been represented to me that it is going to be relevant.

Q Mr. DeVilliers, have you reviewed Plaintiff's Exhibit 23 at any time during your testimony in this Court?

MR. DeRENSIS: I don't understand that question.

THE COURT: I don't understand it myself.

MR. LAGEMANN: Let me withdraw that, your Honor.

Q Have you looked at these drawings which comprise Plaintiff's Exhibit 23 at any time subsequent to the running of the computer simulations?

A Any drawing in the whole pile or the whole pack?

Q The whole pack or any drawing.

MR. DeRENSIS: He has just looked at them right now, your Honor.

THE COURT: It is obvious he looked at them when he was on direct, too.

THE WITNESS: Yes, and I looked at them -- I have several in my briefcase, as far as that goes, so, sure, I looked at them. If I open my briefcase they are in front of me to see sometimes.

Q Mr. DeVilliers, do you know whether there is a drawing of the cam gear in Plaintiff's Exhibit 23 as you see it before you now?

A Not without thumbing through the whole pile.

MR. LAGEMANN: Will you stipulate that there is no such drawing in Plaintiff's Exhibit 23 or would you rather have the witness look through it?

THE COURT: Why don't you have the witness look through it? Go ahead.

MR. DeRENSIS: I don't believe there is a drawing of the cam gear in there.

MR. LAGEMANN: Will you so stipulate?

THE COURT: Let's have the witness go through this.

THE WITNESS: There is a drawing of a cam gear some place. I looked at one.

MR. DeRENSIS: Your Honor, we will stipulate it is not in there.

THE COURT: It is not in there? Okay, fine.

MR. LAGEMANN: Your Honor, I move at this point to strike any and all exhibits relating or pertaining to the computer simulations which were run on a threshhold of .92 G because that figure was calculated from a document containing data which is not in evidence.

MR. DeRENSIS: Your Honor, we, at the close of plaintiff's case, sought to introduce that document. There was an objection, requiring Mr. Perrino to introduce that document. We have it here. It will be put into evidence.

THE COURT: Do you want to stipulate it in, Mr. Lagemann?

MR. LAGEMANN: Absolutely not, your Honor. We have never seen this document before.

THE COURT: Your motion is denied.

MR. DeRENSIS: We gave you a copy of that.

MR. LAGEMANN: You have not given us a copy of this document.

THE COURT: I don't care. The motion is denied.

MR. DeRENSIS: Here is a copy right now. As far as I knowwe mailed it to you sometime ago.

MR. LAGEMANN: Never got it.

Your Honor, is the motion denied --

THE COURT: That is what I said.

MR. LAGEMANN: -- subject to connection to this thing coming into evidence?

THE COURT: Yes.

MR. LAGEMANN: Your Honor, we are going to be discussing plaintiff's 5A. Would you like a copy?

THE COURT: No. I have seen it so many times. Go ahead.

Q Mr. DeVilliers, I have handed you a copy of Plaintiff's Exhibit 5A. I am asking you to look at a part or a component labeled adapter gear on that exhibit. Did you simulate the adapter gear in your computer simulations?

A I simulated it -- yes, it's part -- it's integral to the simulation but not specifically.

Q Did you simulate it as a part of the overall gear ratio which spun the centrifical governor.

A The adapter gear is, as you just said, one of many

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gears between the governor and the rear wheels.

Q Correct.

A All right. And that entire gear train is represented by the gear ratio, and the word gear is even -- well, yes, that's a correct statement. When one uses the word gear ratio, sometimes he is thinking of the ratio of one gear to another one, where as in fact it is a net gear ratio from this governor way back to the back wheels, and to the extent that the adapter gear is mixed up in that, fine, I simulated it.

Q Let me see if I understand you. Is what you are saying that you simulated this adapter gear as a component or part, if you will, of a number of gears running from the rear wheels to the sensing unit which comprised the gear ratio which you used in your simulations?

A Yes, including some of the gears within the car itself.

Q Did you simulate the performance of the adapter gear as a gear meshing with another gear?

A No, I did not. There is no reason to.

Q In the Perma Anti-Skid Device, to what is the adapter gear affixed?

A In the Perma device?

Q Anti-Skid Device, to what is the adapter gear affixed?

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A It is right in front of me. It's affixed to t eir gear box.

Q Is there a component which connects the adapter gear to the gear box, and if so, what is it called?

A I don't know what you'd call that, a link, cable, something like that. This thing here you mean?

MR. LAGEMANN: May the record indicate that the witness is pointing to the area in Plaintiff's Exhibit 5A between the unit labeled adapter gear and gear box.

Q Incidentally, you have studied the Perma Anti-Skid Device, have you not?

A Of course, I studied the Perma Anti-Skid Device.

Q How many parts are there, sir, between the adapter gear itself and the gear box?

MR. DeRENSIS: Can we give him one of the hardware we have available here?

MR. LAGEMANN: Your Honor, I would like to do this just off this drawing.

THE COURT: Absolutely not. It is one of the most unfair requests I have heard in this trial.

A I don't know how many parts are in that train. It could be one part or three.

THE COURT: The record should reflect that Perma Anti-Skid Device, as depicted on Exhibit 5 and Exhibit 5A,

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is not a schematic, is not drawn to scale, does not show all the parts, is merely a representation of the device in such a way that a layman could understand it.

To ask an engineer to count the parts between one section and another, depending upon that, is absolutely and completely, to my mind, unfair.

MR. LAGEMANN: Do you have a cut-away you want to use?

MR. GRAND: Here is the one in evidence.

Q Mr. DeVilliers, I am handing you Plaintiff's Exhibit 3 and 4, which are now connected. Looking at Exhibit 4, which is the adapter gear and gear box component, can you tell me if there is an adapter shaft connecting the adapter gear to the gear box?

A Yes, I see a shaft gear, but I also can tell that it is connected somehow internally to this, and I might say, in answer to you, that you asked me if I studied this -- yes, I studied it. I studied it for what I needed to know, and certainly it was not necessary for me to know the internals of the connection here to get this gear ratio that I was after. All I cared was that it was there.

Q Did you simulate a connection between the adapter gear and the gear boxes?

A Well, the fact that I put a gear ratio in, to imply

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a ratio for all these gears, of course, is a simulation.

Q Does the adapter shaft affect the gear ratio, sir?

A The adapter shaft?

Q Yes.

A No, not that I can see.

Q Did you simulate its performance?

MR. DeRENSIS: I think that has been asked and answered.

THE COURT: Let him answer again. Go ahead.

A To the extent that I assumed that it turned around with the gear that was on it, I simulated its performance.

Q Did you simulate it in any other respect?

A No, I did not.

Q Let's take a look at the component which is labeled gear box in Plaintiff's Exhibit 5A and which you have before you in a cut-away model in Plaintiff's Exhibit 4.

Do you see a number of gears in that gear box?

A Yes, I see two.

Q Did you simulate those gears in any respect other than their being a part of the gear ratio?

A No, I had no need to.

Q Incidentally, I notice, sir, that when you are handling Plaintiff's Exhibit 4 and when you touch the adapter gear that there is a certain woggle or freedom of

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motion here. Do you see that, sir?

A Yes, I see that.

Q Did you simulate that woggle or freedom of motion?

A Woggle isn't a very technical term.

Q I grant you, sir. I am not a very technical man.

It appears that the entire adapter shaft is able to rotate without moving the entire gears in the gear box. Does that appear to be correct?

A On this particular piece that is in front of me, yes.

Q Did you simulate a freedom of motion of the adapter gear relative to the gears in the gear box as a part of your computer simulation?

A No, I did not.

MR. DeRENSIS: That has been asked and answered.

THE COURT: He just said he did not.

By the way, Mr. DeVilliers, is it possible to manufacture that without a "woggle" or whatever you would call it?

THE WITNESS: It could be very much minimized. That's part of a mechanical development program. It's a matter of fineness of design, tolerances, that kind of thing.

Q Mr. DeVilliers, would it be technically possible to manufacture a mechanical device of this nature with absolutely no motion or woggle, as the Judge and I have come to call it?

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A I would have to say that there is not very much of anything in this world which you can measure and say it is zero, but you can make it smaller.

Q Is your answer, then, sir, yes or no?

MR. DeRENSIS: Asked and answered, yourHonor.

THE COURT: I understand the answer.

MR. LAGEMANN: Very good.

A And, of course, the whole thing has to be taken into, you know, in deciding whether two --

THE COURT: Wait a second. There is no question. Just hold on, okay?

THE WITNESS: I'm sorry.

Q Mr. DeVilliers, at the present time, connecting Plaintiff's Exhibit 4 and Plaintiff's Exhibit 3, there is a black rubber coated device which I believe is the component labeled as flexible shaft on Plaintiff's Exhibit 5A. Do you see the device that I am holding?

A Yes.

Q Did you simulate the performance of the flexible shaft in your simulation?

A What do you mean by performance?

Q Let me ask the question again.

Did your simulation take into account the fact that the Perma system has a flexible shaft connecting the gear box

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to what is labeled on Plaintiff's Exhibit 5A as the sensing unit?

THE COURT: What he is trying to ask you, Mr. DeVilliers, did you include any possibility of torque in between the two items?

THE WITNESS: Yes, of course. It is implicit that thereis torque between these two items and that that shaft will transmit that torque.

Q Did you simulate any torsional elasticity of the flexible shaft?

A I studied the thing and concluded that it was minimum.

Q What did you study?

MR. DeRENSIS: Will you let him finish his answer, please?

THE COURT: Let him finish. Go ahead.

A I studied it, studied it as a torsional spring, connected on the other end to the rotating inertia up in this governor, through this gear train and concluded that any frequency of oscillation which would be induced by that thing would be far in excess ofthe cycling speed in the sense that Perma unit cycles, so far in excess that it was negligable in the performance of the system.

Q What data did you study which led you to your con-

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clusions with reference to the flexible shaft?

2-3 A I believe I asked Mr. Perrino about that shaft, and he explained to me that he had the latest shaft. He gave me some technical data on it. The details of it I don't remember, but I was able to use it at the time to draw that.

Q Did he give you a document?

A A document?

Q Yes.

A No. He told me in words.

MR. LAGEMANN: Your Honor, I must note again at this time that Mr. Perrino's testimony is devoid of any data with reference to the flexible shaft and --

THE COURT: We will have him back. You can ask him that.

MR. LAGEMANN: Do I understand, your Honor, that Mr. DeVilliers' simulations will be taken subject to that connection as well?

MR. DeRENSIS: Your Honor, I think there is a reference in his testimony to that flexible shaft and there is also a reference in Mr. Goor's testimony to that flexible shaft, and the nature of the torsional flexibility of it.

MR. LAGEMANN: If I may speak to that, your Honor, Mr. Goor's reference to it is unsupported by any document in evidence, and it, too, should be stricken on the same grounds.

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THE COURT: Any document in evidence?

MR. LAGEMANN: That is correct, your Honor.

THE CORT: No.

MR. LAGEMANN: It is also unsupported by any -- I believe Mr. Goor stated, your Honor, he saw documents giving these figures, and these documents have never been provided to the Court.

MR. DeRENSIS: Your Honor, he has also examined the very thing that is in front of him, which contains a flexible cable.

THE COURT: You are talking about 23?

MR. DeRENSIS: No, I am talking about 3 and 4, the connection between 3 and 4.

Q And have you examined this particular cable, sir?

A That particular cable?

Q Or a cable like it?

A No. I examined what it is they are to do.

Q Did you measure the torsional elasticity of it?

A No, I didn't measure this. I assumed, justifiably, that if one wants to transmit torque from here to here and motion, that one can do it.

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Q Mr. DeVilliers, I am handing you copies of Plaintiff's Exhibits 132, 133, 133A, 134 and 135. Do these documents, sir, comprise all of the inputs into your simulation?

MR. DeRENSIS: Does he mean numerical inputs?

THE COURT: I don't understand the question.

A These documents describe --

THE COURT: No, no. If I don't understand the question, how can I understand your answer?

Q What do these documents contain?

A I could refer you to my direct testimony --

Q Very well, let's just back up. Let's take a look at Plaintiff's Exhibit 132. Were the formulas and equasions contained in this document entered into the computer during your computer sir ulations?

THE COURT: All of them? Is that the question?

MR. LAGEMANN: Yes.

A This model was modeled in our computer simulation. As a matter of fact --

MR. LAGEMANN: Let the record indicate that the witness is pointing to the schematic, if you will, with the letters and numbers attached on the front page of Plaintiff's Exhibit 132.

Q Please continue, sir.

MR. DeRENSIS: Could you read the question back to

the witness?

THE COURT: He wants to know if all of the formulae set out in Plaintiff's Exhibit 132 were put into the computer.

A Yes, they were. What I am getting at is that the original computer model is not only this model, but, if anything, it is even more -- it includes, for instance, some wind drag, but this is the model that was simulated, and this is in the computer. These equasions --

Q You have lost me, sir. You say the original model contained wind drag? What do you mean by the original model?

A I mean the model that's in the computer. It is the same one. This is the documentation. Such things as, for instance --

Q Let me --

MR. DeRENSIS: Let him answer.

MR. LAGEMANN: I'm trying to get back to the wind drag question.

Q Were you going to discuss wind drag, Mr. DeVilliers?

A I was going to point to another area.

THE COURT: Very well, let's get back to wind drag.

Q Did the computer simulations which you ran for this case contain wind drag data?

A Yes, it had a drag co-efficient for the car.

Q Is there any wind drag co-efficient contained in Plaintiff's Exhibit 132?

A On this exhibit where it shows the general LaGrange equasions of motion, on the far right of the equals sign there is a term, a letter that says Q_i. That would come in as a generalized force represented by drag to the car going through the air, which simply helps the brakes, of course. It is very minimal and I saw no point in writing that down here.

Q Writing it down where, sir?

A In putting it in, when I wrote, prepared this documentation.

Q I am afraid you have lost me. We are talking about the same document.

A Yes.

Q Let me see if I understand you. This term on page 2 which is Q_i --

A Yes. That is a place for a force.

Q Are the computational processes which came to that value contained anywhere in Plaintiffs Exhibit 132.

A Wind drag? There is not any wind drag in this exhibit that's in front of me, no, that is true.

Q In other words, you had wind drag in the computer and yet you have not given us the formulas which you used to create or recreate, if you will, wind drag in an automobile;

is that correct?

A That's true, because I considered the whole thing negligable. I had the deck for a while. I just left it there.

Q You say "deck" did you use cards or tape?

A I used cards.

Q So you have a card deck?

A Yes. It is a matter of entering the source program into the computer.

Q But there is a deck? There is a deck?

A Yes.

Q Does the deck still exist?

A Yes.

Q Would that deck contain something pertaining to wind drag in it?

A Yes. The simulated results which were presented here have wind drag in them.

Q And yet they don't --

A I can assure you that it is rather small. To show you the effect of it, on one time running that model in which the brakes never came on, the computer ran all night trying to stop on the wind drag, so there is not much there to do it.

Q But, in any event, sir, did you include wind drag or any computation in any of the documents that you prepared?

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A You do not have any wind drag there.

MR. DeRENSIS: Your Honor, that's been answered already.

THE COURT: Yes. He said there is no wind drag there.

Q Directing your attention to 132, can you point to a formula in there, sir, which represents oscillation of the flexible shaft?

A No, I can't.

Q Did you simulate oscillation of the flexible shaft?

A I just explained that I decided it was negligible. It didn't obviously simulate it. Why bother? Something that is very negligible, if something had a very high frequency, of oscillation, one can assume it isn't very rigid.

Q How did you decide that oscillation of the flexible shaft was negligible?

A Again, based on the fact that either the flexible shaft that was there or one that would be put there, that it does not have to, a priori, have a lot of flexibility between here and here, so why simulate it?

Q Did you reach that conclusion in the process which you just described or did you analyze any data or enter any books on the subject, or anything else?

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A I basically studied the hardware and the drawings and talked to people and made my conclusion.

Q Did you study a drawing of the flexible shaft?

A I don't remember whether I specifically looked at the drawings of the flexible shaft or not. I might have. I just don't remember. I was just simply concerned as that it was there.

Q Take a look at the component labeled drive gear, Plaintiff's Exhibit 5A. Did you simulate the performance of that gear in any respect other than the fact that that gear was involved in the overall gear ratio?

MR. DeRENSIS: Your Honor, hasn't that been answered in a different way?

THE COURT: I don't know. Try it this way. Go ahead.

A The answer has to be the same. It is just part of the overall gear ratio.

Q Is the answer no.

MR. DeRENSIS: He answered that, your Honor.

THE COURT: He answered it. It is part of the overall gear ratio.

3-2 Q Was it simulated in any other respect?

MR. DeRENSIS: That's been answered, your Honor. I thought that was his original question.

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MR. LAGEMANN: I don't believe we ever got a yes or no on it.

THE COURT: Anything than the gear ratio, did you have any other --

THE WITNESS: No, no, I did not. That's it.

Q Take a look at the component call cam gear. Did you simulate the performance of the cam gear, sir?

A The cam gear was represented in the two areas again that we have testified to, I believe previously, namely as part of the gear ratio and as the trigger -- part of the triggering device for the system.

Q In other words, you simulated cam gear in two respects; is that correct?

A Of course, because the thing exists in two respects.

Q Did you simulate the gear performance of it as a gear meshing with another gear?

A No, I didn't do that.

THE COURT: You mean separately, not as part of the whole gear ratio?

MR. LAGEMANN: Yes.

A (Continuing) Wait. I think maybe we better qualify that slightly. If you mean meshing with another gear, does one turn the other, yes. It is simulated. I assumed it had teeth on it, for instance.

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Q Did you simulate it with respect to gear backlash?

A No. That answer would have to be the same as earlier.

Q Come to think of it, Mr. DeVilliers, did you simulate any backlash occurring at any point from the wheels through the axle to the differential, through the drive shaft, U joints, into the transmission, through the adapter gear, gear box, flexible shaft and cam gear, did you simulate any backlash occurring in any of those components?

A During the governor operation of the system, backlash wouldn't occur whether it is there or not, given this hovering characteristic we described.

Q The question, sir, is did you simulate it?

A No, I didn't put any backlash in.

Q Could backlash in the components I just described have any effect on the function of the cam gear in arming the system?

A It would depend on how.

Q Would it depend upon the magnitude of the backlash, sir?

A It would have to be that kind of an answer. Obviously, if the thing was too excessive, it might not work. But it is a matter of degree.

Q Did you compute, sir, whether such backlash would

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A I said earlier that because of mechanical things or physical things, within this mechanical train, even if you got down to measuring at the microscopic level, no matter what you did, there would -- because two things are mentioned, three or four, there has got to be some.

Q Some backlash?

A You are using the word backlash. That has very negative connotation. Some motion.

Q Some --

A Relative motion.

Q Relative or perhaps lost motion, would that be a more appropriate term?

A Motion.

Q Would that motion be motion which was irregular? Let me put it another way, sir.

A The same unit is going to have the same motion each time.

Q Each time? Can't there be variations in backlash?

THE COURT: He is using the word motion. Can there be variations in motion caused, for example, by wear?

THE WITNESS: Oh, yes, wear, yes.

Q Or caused by different road conditions?

A I don't see how a road condition would get into it.

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Q Suppose you went over a bump or perturbation somewhere in the road, wouldn't that cause a shock to go traveling up through the axle to the differential to the drive shafts to the U joints?

A Sure.

Q Would that shock be picked up here at the adapter gear and transmitted into the anti-skid unit, or that component labeled on Plaintiff's Exhibit 5A?

A The representation of the shock would be, but it would be affected by the gear ratios.

Q Did you say would or would not be affected?

A It would be.

Q Certainly. Would the shock be --

A Let me say that if you hit a bump down here, you know something is going to be felt up here, but it may not necessarily be as hard.

Q Let's say we did hit such a bump, sir. Would that bump be transmitted to the anti-skid unit as an acceleration or deceleration of the flexible shaft?

MR. DeRENSIS: Your Honor, I think we ought to make it clear whether we are talking about a bump on the road or a bump to the gear box.

THE COURT: I think it is clear. Go ahead.

A If that bump was hit in such a manner as to accelerate

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or decelerate the wheel instantaneously, of course it would.

Q Let's assume that the bump is not hit in such a manner as to accelerate or decelerate the wheel but only to transmit a shock through the vehicle drive train.

A I would say then --

THE COURT: Wait a second.

(Record read.)

MR. DeRENSIS: I object to that because there is no foundation laid, that such a shock would be transmitted unless there is a wheel deceleration or acceleration.

THE COURT: We are in the realm of pure theory, absolute and complete, pure theory. It doesn't happen in the real world. Now do you really want the question answered?

MR. LAGEMANN: I believe, your Honor, that we are in the realm of pure theory throughout this simulation.

THE COURT: Do you want it answered? Yes or no.

MR. LAGEMANN: Yes.

A I can't see how any shock that did not in some way produce an acceleration or deceleration of the wheel is going to show up here.

THE COURT: Pointing to the sensing unit.

THE WITNESS: Yes, the sensor. It might bend the U joint of the car a little bit.

Q Mr. DeVilliers, when you were working at Kelsey-

Hayes, were you aware of any efforts by Kelsey-Hayes to employ a transmission mounted wheel speed sensor?

A Yes.

Q I show you a copy of Plaintiff's Exhibit 121, page 6, figure 5. Is that a rough schematic of this transmission mounted wheel speed sensor as used in Kelsey-Hayes?

A Having always been around that at program -- I mean intimately around it, you know, desk to desk type of intimacy, I would not want to say that this is exactly or wasn't, for that matter, what they did. I only know that they were working with such a device. If they testified they put it in this paper, fine. That's it. Why argue about it?

Q Did they ever market such a device?

A No, to my knowledge, they didn't put that into the market.

Q Do you have any idea why they didn't market that device?

A It was an electrical device. They used an electronic speed sensing device.

Q Excuse me. What was, this, figure 5 of Plaintiff's Exhibit 121?

THE COURT: That is not what he is testifying to.

A Kelsey-Hayes wheel speed sensor, whether you put it out on the wheel or up in the drag frame, at least at the

time I was involved with it, was an electromagnetic device which produced a very high frequency in terms of relative -- that is to the speed of rotation of the wheel, voltage, and this voltage -- the oscillation of this voltage was used to produce electronic pulses, electrical pulses, which were then counted and averaged to produce a speed. Much different than obviously is happening here.

3-3

THE COURT: The question was do you know why they didn't use the wheel mounted sensor?

THE WITNESS: The transmission mount.

THE COURT: Transmission mount, I am sorry.

THE WITNESS: Because of that frequency of pulsing, any acceleration or deceleration type of shock in the drive train could produce noise, electrical noise.

Q What was that electrical noise read as?

MR. DeRENSIS: Could you have him complete his answer before you --

THE COURT: I think he did. Did you complete it? "Because it created electrical noise."

THE WITNESS: Yes. Such electrical noise could come through as a false signal.

Q Incidentally, is this what you would call an electronic pulse generator? Did they mount a rotor and stator in there which generated signals?

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MR. DeRENSIS: Can you tell us what "this" refers to?

A It looks like transmission to me. This must have been that. They used a common type of sensor, rotory sensor. Whether they put in at the wheel or the transmission, this must have been there.

Q Let's see if we can firm that down. Why don't you read the right-hand column --

THE COURT: Is this in evidence?

MR. GRAND: This is in evidence. If the witness doesn't know --

MR. LAGEMANN: To refresh his recollection on it. He says he is not sure.

Q Would you please read the right-hand column on page 6 of Plaintiff's Exhibit 121 and tell us if in fact it did, "it" meaning the transmission mounted sensor, employ an electronic pulse generator.

A I observe they even refer to the electrical noise I talked about.

Q That's correct.

A The module sometimes read as skid signals.

Q The question, sir, is whether that statement refreshes your recollection as whether Kelsey-Hayes did in fact employ rotors and stators in the transmission mounted wheel

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speed center.

MR. DeRENSIS: Your Honor, didn't he just answer that?

A It's right here. Even without reading this, I would say yes, to the best of my knowledge. I am just reading here to find out the exact details.

Q Could an electronic pulse generator by itself create a false signal if you had a constant speed drive going in?

A Absolutely, by itself, I can't be sure. I am not an electronic engineer. The lights in the room might even put a false signal into it due to electromagnetic radiation, if you want to be speculative about it.

THE COURT: Sure. The thing could burn out too. Okay. Let's take a break.

(Recess.)

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BY MR. LAGEMANN:

Q Mr. De Villiers, I am directing your attention to Plaintiff's Exhibit 3 which is, of course, the cutaway of the anti-skid unit. I am looking at the cam gear in this case. Do you see a pin in that cam gear?

A That little thing right there. Yes, I see a pin down there.

MR. DeRENSIS: We can't hear you.

THE WITNESS: I'm sure we were both looking at the same pin.

MR. LAGEMANN: May the record reflect that we both are.

Q What is that pin which we see resting on the cam gear attached to?

A That pin is attached to the main drive shaft of the governor.

Q Is the governor driven by the main drive shaft of the governor?

A Yes.

Q When you state governor, sir, what are you referring to?

A These flying weights, the spring combination, rotating above that axis.

Q That is the governor which comes into operation once

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the system has been armed?

A No, that governor is moving all the time.

Q Is that the governor which is moving all the time but which can respond to variations in wheel speed only after the system has been on, the solenoid armature has been withdrawn?

A Yes.

Q In order to accelerate the governor to which we have just referred, does the pin have to be in the position we see it here which is at the bottom of the slope of the cam gear?

A Yes.

Q In order to decelerate the governor, does the pin in the governor shaft have to be at the top of the incline plane in the cam gear?

A No.

Q In order to decelarate the governor, using the figures in your simulation, at accelerations of over .92 G, would the pin have to be at the upper end of the incline plane in the cam gear?

A Yes.

Q Incidentally, during the simulations, did you encounter decelerations at the wheels in excess of .92 G?

A Well, yes, several times far in excess.

Q So whenever that happened, the pin would have to be at the top of the incline plane of the cam gear, would it not?

A Yes.

MR. DeRENSIS: Your Honor, would have to be or would be? I'm not sure.

THE COURT: Would be. I understand.

A Let me qualify that slightly. It would get there within a few milliseconds, in the process of climbing the hill. The deceleration could actually occur when it is climbing the hill. That is the whole principle of the thing.

Q Is the cam gear directly affixed to the governor shaft

A No, it fits over it.

Q Does it have a freedom of rotational motion relative to the governor shaft?

A Within the groove, within the range of motion relative to that pin, yes, it does have some freedom of rotational motion.

Q Approximately h ow many degrees of freedom of rotation motion does the cam gear have relative to the governor shaft?

A I will try and remember.

Q Would it be approximately 100 degrees?

A I have to look at the thing. I figured this out once and I just don't remember. The way to get that answer is

to count the total number of teeth on the gear and then count the number of teeth represented by --

THE COURT: A hill.

A -- a hill, and just take the ratio of two times 360.

Q Why don't you do it, if you can do that quickly?

A It's a lot of counting.

MR. DeRENSIS: Perhaps if you gave him 142 for identification it would be simpler.

(Pause.)

A About 5 over 13 times 360.

MR. DeRENSIS: Perhaps we can give the witness a slide rule and make it easier.

MR. LAGEMANN: He is almost through, Mr. DeRensis.

(Pause.)

MR. GRAND: On this one I count 16.

THE WITNESS: You have got 16? That's good, because I may have miscounted going around there.

THE COURT: Do you have a slide rule?

THE WITNESS: That's about 130 degrees based on the number --

THE COURT: Do you have a slide rule?

MR. BENBOW: I have a slide rule.

THE WITNESS: It's about 130 degrees.

Q 130?

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jk 5 De Villiers - cross

MR. GRAND: That's assuming there are 13 teeth.

A Assuming 13 teeth.

MR. GRAND: As I say, the document says 16. I counted 16 in another.

THE WITNESS: If you have got 16, let's use 16.

Q No, let's count the number of teeth in Plaintiff's Exhibit Number 3.

MR. LAGEMANN: I would like to note for the record that while the witness is counting, that the reference to 16 teeth comes off of a document which is not in evidence.

A I'm afraid I seem to count 13 here.

Q All right, figuring 13 teeth, as you see before you in Plaintiff's Exhibit 3, is there a rotational freedom of 130 degrees approximately --

A Let me double check now as long as I have got my "wooden brain" here. It's about 138 and a half degrees.

Q Mr. De Villiers, once the system has been armed, is the cam gear free to rotate 130 degrees relative to the governor shaft?

A Yes, relative to the governor shaft. Wait a minute, I want to -- if you took the little governor out of there, yes, it could. However, the fact that the pin is on the hill there, it can rotate but it is already exerting a deceleration on the governor itself, even though it is still

climbing the hill. So it is not that absolutely free, you see; because of the hill it can apply a force which will start to decelerate that.

Q Let's back up. Are the governor weights directly affixed to the governor shaft?

THE COURT: Directly affixed?

MR. LAGEMANN: Yes.

THE COURT: I don't know what that means.

A They're pinned.

Q Are the governor weights pinned to the governor shaft so that they are not free to rotate with respect to the governor shaft?

A They do rotate with it.

Q They rotate with it. Do they have any freedom of motion or rotational motion with respect to the governor shaft?

A No.

THE COURT: In other words, if the governor shaft is not moving --

THE WITNESS: They're not moving, or vice versa.

Q And there is no freedom to move there, is there?

A Not with respect to the shaft. I'm sorry, it was a little confusing.

Q There is a freedom of motion between the governor

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shaft and cam gear, is that correct?

MR. DeRENSIS: I object to the word "freedom" of motion, because I thought he testified that there was some restraining force here due to inclination of the gear, so he is misstating --

THE COURT: Well, I think I understand what he is trying to say.

Do you?

THE WITNESS: I'm not sure.

MR. LAGEMANN: I will reframe the question.

THE COURT: Reframe the question.

Q What is the restraining force, sir, on the freedom of motion between the governor shaft and the cam gear?

A The spring in the microswitch presses on the cam gear which presses on the pin. Since the cam gear has an incline in it, that part of that, a component of the micro-switch and spring force is transmitted to the pin in such a manner as to restrict the motion of the governor. It is part of the design of the system.

Q Wait a minute. Now, it --

MR. DeRENSIS: Let him finish his answer.

MR. LAGEMANN: I think he did.

Q Are you finished?

A Yes, that answer stands.

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Q Now, the force of the leaf spring which is pushing against the end of the cam gear, which does not have the slot -- right?

A Yes, yes, okay.

Q Now, does that force hinder the freedom of motion which would cause the in in the governor shaft to rise in the cam gear slot?

A Well, first it is supposed to.

Q If decelerations of over .92 G, to use the figures in your simulation, were encountered while the system was armed in operation, would the pin rise on the cam gear slot?

MR. DeRENSIS: Your Honor, there is a physical impossibility here. If the system is armed, how can you have deceleration?

MR. LAGEMANN: I object to this testimony by the lawyer. If it is a physical impossibility, I think the witness should be answering it and certainly not Mr. DeRensis.

MR. DeRENSIS: There is no foundation laid for this. The first question should be, "Is there?"

THE COURT: Let me ask you a question first, all right? When the pin is going up the hill, is the microswitch engaged?

THE WITNESS: The microswitch is engaging; you know, the microswitch has to move a small amount against the spring

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to engage, and as it climbs the hill it pushes it back, but there is a force in the microswitch and that is what produces the .92 G, the G requirement.

MR. BENBOW: Keep your voice up, please, Mr. De Villiers.

THE WITNESS: Yes, sir; I'm sorry.

Q However, when the system is armed, Mr. De Villiers, if the pin were to climb the cam gear plane, and push against the spring, would it have any effect on the operation of the unit, keeping in mind, of course, that the solenoid is already retracted?

A When the system is already armed, if the solenoid is already retracted, the circuit has already been closed a second time back here and the cam gear and the microswitch are irrelevant. It is a redudant circuit closure.

THE COURT: That is what I thought. Okay.

Q If the white Delrin gear, which is labeled drive gear in Plaintiff's Exhibit 5-A, were to decelerate, let us say, at 1.5 G --

A 1.5 G of the rear wheels.

Q Yes.

A Okay; fine.

Q -- would the pin climb the incline plane in the cam gear?

A Yes, it would; no doubt.

Q And would the relative position of the cam gear in the governor shaft change while that was transpiring?

A Yes, it would.

Q Would it take a period of time for this to happen, a finite period of time?

A Yes, it would.

Q Have you calculated how long it would take?

A Precisely, no. Let me think. I have done some calculations in that area, yes.

Q Well, what were the results?

A And, in fact, it would depend on the degree, the time itself, because of the fact of the inertias involved.

THE COURT: Keep your voice up.

A The time itself could vary with the magnitude of deceleration posed. For instance, with a very gentle or buildup of the deceleration it could simply follow, climb the hill just as the deceleration was being generated.

Q And if you had a higher level deceleration would it take a shorter period of time?

A If it took a quickly-applied low level of deceleration, it would take one period of time. If it took a quickly-applied, very high level of deceleration it would take a shorter period of time.

Q Just try to establish this. Is the governor driven by the cam gear?

A Yes.

Q All right, now, if the pin is in the upper position of the cam gear slot, there is a deceleration --

A Yes.

Q -- is the pin going to go down?

A The pin is already in the upper --

MR. DeDENSIS: I object to that, pure speculation; there is no foundation that that could ever take place.

THE COURT: Let him answer it.

A If the pin is in the upper position of the slot, there is already a deceleration occurring, or it wouldn't be there.

Q All right, what happens then -- suppose there was an acceleration?

A It goes back down again.

Q Would it take a period of time?

A That is dependent on how fast the acceleration can occur.

THE COURT: It is a finite period of time.

THE WITNESS: It would take a period of time without doubt, some period of time. I don't know how long it would be, but it would be fast.

THE COURT: The period of time that we are talking

about, would it be measured in milliseconds?

THE WITNESS: Yes.

Q And, of course, during the acceleration, would that period of time be affected by the force of the leaf spring operating against the end of the cam gear?

A Yes, it would.

Q Would it be shortened by the --

MR. DeRENSIS: Would what be shortened, in relation to what?

THE COURT: The period of time.

Q -- that it takes the pin to travel back down the incline plane in the cam gear?

A Let me think for a minute. There is some complexity in that area that I want to make sure that I adequately elucidate.

Q Indeed, sir, there is.

A During the drop back down the hill, if, for instance, we had a -- well, during the drop back down the hill, if for some unknown but extremely high reacceleration or acceleration is what I should really say, the pin might even momentarily break contact with the cam gear. However, now, we have another dynamic system involved, namely that of the mass of the cam gear traveling back and forth on the shaft, combined with the spring in the governor switch. It is my opinion -- and I

didn't specifically calculate this, that that mass is so light that there would be a very great difficulty for that cam gear not to actually just follow the pin.

Q While this cam gear is traversing either up or down --

MR. DeRENSIS: I can't hear you.

Q While the pin is traversing the cam gear, is there any, let's say we are in a deceleration sense and it is going uphill, is there any lost motion between the rotation of the drive gear --

MR. LAGEMANN: Withdrawn. Let me start all over.

Q When the system is decelerating and the white drive gear is decelerating, let's say at 1.5 G, is there any lost motion or lag between the deceleration of the drive gear and the deceleration of the governor?

MR. DeRENSIS: Could we have a definition of "lost motion" here?

MR. LAGEMANN: I think the witness is --

THE COURT: I understand. Go ahead.

A I think you mean acceleration, spinning back up again, the wheels speeding up again.

Q Either one. No, actually I think I meant deceleration, when we are climbing the hill.

MR. GRAND: Is this a dialogue that the reporter is picking up?

THE COURT: I hope so.

MR. LAGEMANN: I apologize.

THE WITNESS: I'm really having difficulty coping with this question because I'm not even sure what question I am answering any more.

MR. GRAND: That's an answer.

Q When the drive gear is decelerating --

A Yes, okay, when the drive gear is decelerating.

Q -- at the start of the deceleration input, would the pin be located at the bottom of the slope of the cam gear?

A Yes, it would, most likely. It does not have to be in all cases, but let's assume that it is. It certainly could be.

Q Let's assume further that there is a deceleration of 1.5 G at the drive gear.

A Yes, all right.

Q Now, as we have already established, this will cause the pin to climb the incline plane in the cam gear, is that correct?

A Yes.

Q Which will take a finite period of time?

A Yes, it will.

Q During this finite period of time, is the centrifugal governor decelerating at the same rate that the drive gear is

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decelerating, during the period in time when the pin is climbing?

A No, it would not. It is building up to it.

Q That's right.

A It is building up to it.

Q Could one term that buildup a lag in the relative acceleration rates of the drive gear as opposed to the governor?

A That is precisely what is represented by, I believe, 20 milliseconds in the simulation. The governor time constant, cam gear time constant.

Q Showing you --

A It won't show up on there. It shows up somewhere in the representation.

Q Mr. De Villiers, you have mentioned a 20 millisecond lag in the operation of the arming function of the system, is that correct?

A Yes.

Q Relative to the cam gear.

A Not a delay; a lag.

Q A lag.

A Okay.

Q And where is the 20 millisecond figure found?

A Right here.

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MR. LAGEMANN: Okay, the witness is indicating item number 6 on page 1 of Plaintiff's Exhibit 135.

Q Is that 20 millisecond lag entered into the formula which is on page 4 of Plaintiff's Exhibit 134 and which is labeled Deceleration Sensor?

A Yes, it would be. It is call Tau sub d e c. I had forgotten about that; these were down here.

Q Was the 20 millisecond lag and the formula which represents it used in computing the time it would take to arm the system?

A I think in the sense you mean it, yes.

MR. DeRENSIS: Perhaps we ought to have some clarification of what sense is being use by each.

THE WITNESS: That equation is right in the simulation. That is a deceleration sensor equation represented in the simulation. That is how it is used. It is a differential equation.

Q Was this formula used in the computation of governor response after the system had been armed?

A Yes; both ways.

Q Used both times?

A Yes.

Q It was not branched out?

A No, used both times. I think I understand what you

you are trying to ask. Yes, that formula affects -- that little differential equation gets back to -- it is a first order device again. The model is such that I described last time, and for an input of deceleration at the drive gear, that is the following deceleration represented in the governor. It comes up with that buildup, so that if the drive gear suddenly steps up with this acceleration, the governor follows it up like that, and this is 63 per cent. It works the same way when it goes the other way.

Q Mr. De Villiers, does the 20 millisecond period pertain to the time it would take the pin to climb the incline plane in the cam gear or does it pertain to the time it would take the pin to go back down?

A Both ways.

MR. DeRENSIS: I think it has been answered.

THE COURT: He said both ways. It is the second time he has said it.

A Again, it is a modeling of the thing, as a first order device, because of friction, et cetera, in there, but it is a complicated device.

MR. GRAND: We can't hear the witness and we don't know if he is answering a question or not.

THE COURT: He said it is a first order device.

THE WITNESS: Sort of a representation of the device.

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Q Mr. De Villiers, didn't you previously state that it would take a shorter period for the pin to go back down the incline plane because of the force of the spring operating on the end of the cam gear?

A Yes, that is, it could. It doesn't have to. You see --

THE COURT: All right, it could. It doesn't have to. That's enough. Next question.

Q Mr. De Villiers, if the force of the leaf spring is pushing on the back of the cam gear, wouldn't it tend to propel, if you will, the pin down the incline plane?

am A Sure.

Q Wouldn't that shorten the period of time it would take for the pin to go down the plane?

A Shorten it relative to what?

Q Relative to the time that it takes to climb it.

A Climbing is working against it.

Q When it goes down, it is working with it, isn't it?

MR.DeRENSIS: Are we assuming the forces are the same here, both going up and going back.

A That's what's going to make it go down in the first place, otherwise. That's the only thing that will make it go down.

Q Wouldn't an acceleration make it go down?

A If you simply accelerated it without the leaf spring there, the cam gear wouldn't even move, actually. It's the only thing that makes it go down. But, you see, there is friction in there. It is the integral part of the whole thing.

THE COURT: Mr. DeVilliers, what do you understand a millisecond to be?

THE WITNESS: One thousandth of a second.

Q Mr. DeVilliers, would you look at the formula following the words "Deceleration sensor" on page 4 of Plaintiff's Exhibit 134 and tell us if the friction in the operation of the cam gear to which you just referred is entered

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into that program.

A It is implied in the time constant.

THE COURT: But you did use the time constant, right?

THE WITNESS: Yes.

Q Mr. DeVilliers, isn't the behavior of that governor really a second order system?

A To the extent -- yes, there are second order effects in there. I chose to represent it as a first order device because I deemed it to be reasonable. This is not uncommon at all.

Q Yet there are second order characteristics in there; is that correct?

A Oh, yes. No doubt.

Q Would those second order characteristics have anything to do with the performance of the governor?

A As a matter of fact, that was what I was elucidating earlier, where I was saying that the time constant -- the time of actuation actually varies the initial effects that would vary it, to the benefit of the system.

Q I don't think you quite responded to my question, Mr.DeVilliers.

MR. DeRENSIS: I object to that.

THE COURT: I think he did too. Do you want to ask

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another question?

MR. LAGEMANN: May we have the answer read.

(Record read.)

Q What do you mean by the initial effects that would vary it to the benefit of the system? Is that your first order characteristic?

A No. Remember when I was describing how a gradually applied deceleration -- the pin would almost stay right with the acceleration as was occurring and almost would not be a dynamic thing? On the other hand, a lightly applied -- a low magnitude but quickly applied step of deceleration could cause it to take one amount of time to get to .92 G's, whereas a very high magnitude quickly applied deceleration would take another amount of time to get to .92 G's, simply because it is heading for a much higher value, so it is going to cross through there quicker.

Q Mr.DeVilliers, is the formula following the word: "Deceleration," in the center of Plaintiff's Exhibit 134, is that a first order differential equasion?

MR. DeRENSIS: Can you give us a page?

MR. LAGEMANN: Page 4 of the exhibit.

A Is that the one that says brake torque combine with Perma-Vac?

Q No. The one that follows the words "deceleration

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sensor."

A Yes, that's a first order differential equasion.

Q Isn't it possible to simulate backlash with a first order differential equasion?

MR. DeRENSIS: I thought we agreed we weren't going to use the word backlash, but some other word.

THE COURT: Let's use bac lash. I think we understand it.

A A backlash is an algebraic thing, so it is not in-- you can't -- it is not something that implies a rate of change, like a differential equasion implies, so --

Q So it couldn't be done?

A Let me think. I don't want to say absolutely.

MR. DeRENSIS: Objection.

THE COURT: Let him answer.

(Pause.)

A (Continuing) I could think of one -- yes, it could be simulated, as such. I could think of one way to do it.

Did you do it here?

A No.

Q Do you see the formula following "solenoid" on the same page of the same exhibit?

A Yes.

Q And does that refer to the solenoid actuation time

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which would be on Plaintiff's Exhibit 135?

A Yes, it does. Tal sub sol refers to such.

Q Did that time constant come into play in your simulation after this system had been armed?

A Yes, it did. The solenoid does not start to move until the microswitch is closed.

Q Once the microswitch is closed, what happens in the Perma system?

A Once the microswitch is closed and, of course, assuming the pressure switch has already been closed earlier, the solenoid coil now has a current going through it and the solenoid will begin retracting to allow the governor to operate.

Q What happens when the solenoid armature becomes fully retracted?

A It touches the back of the solenoid casing which closes another circuit, the same effective circuit that the microswitch closed in the first place, thus allowing the microswitch to become disengaged and still have the solenoid held in its retracted position.

Q Is that circuit which is closed when the armature reaches the back of the solenoid sometimes called a holding circuit, if you know?

A I hadn't heard that name applied to it, but I don't

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care what you call it.

Q What breaks that circuit?

A When the pressure drops below the low pressure setting of the pressure switch, that circuit is broken.

Q Is it broken before then if the system remains in operation?

THE COURT: I am not sure I understand the question.

MR. DeRENSIS: I think there is some confusion over the system remaining in operation.

Q When the system is armed, the microswitch is closed is that correct?

A Yes.

Q When the microswitch is closed and the pressure switch is closed, current is sent to the solenoid, is that correct?

A Yes, and the solenoid starts retracting.

Q When the solenoid fully retracts to the back of the solenoid, it closes a circuit.

A Yes, the same circuit in effect that the microswitch closes.

Q When this circuit is closed, does the microswitch have any effect on the solenoid?

A No, it doesn't.

Q In other words, in essence the microswitch is taken

out of that circuit?

A Yes.

Q Now the system has been armed and the governor is taking over the control of the wheels by expanding and collapsing, right?

A Yes, yes.

Q When vehicle speed gets down to governor collapse speed and the governor can no longer collapse, what happens?

A The governor can no longer collapse? It has collapsed.

Q Can no longer expand.

MR. DeRENSIS: I don't understand.

THE COURT: I don't understand myself.

Q What happens to the operation of the unit?

A The pressure drops, it opens the pressure switch, the solenoid begins moving to an extended position again, which forces the governor or weights to expand its position and reapplies the brakes.

Q In between those two periods of time, between the arming of the switch and the disarming of the system, what had been happening at that solenoid? Has this armature moved in and out?

A We just -- the solenoid has been back, retracted at the rear. It is going to stay there until that system is

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broken, so, of course, that is where it stays.

Q If that solenoid is fully retracted, why is the solenoid response time entered into the calculations of the operation of the governor?

A You are the one that said it was fully retracted.

Q Mr. DeVilliers, once this solenoid is fully retracted upon arming of the system, does that solenoid response time come into play again at any time before the system is disarmed by the operation of the pressure switch in your simulation?

A Would you restate that or reread it? I think it would be better if it is restated because it is a very touchy area.

MR. BENBOW: It seemed clear. Why don't you have it reread?

MR. DeRENSIS: I don't understand the question, your Honor.

MR. LAGEMANN: We are having it reread. You can understand it or not understand it later.

(Record read.)

A No.

MR. DeRENSIS: I object to that on the grounds --

THE COURT: The answer is no.

Q In other words, when the governor is expanding and

collapsing in the period between the arming and the disarming the solenoid response time is not computed in the simulation; is that correct?

A The solenoid -- wait a minute. I better correct that. The solenoid response time, or better put another way, the response of the solenoid is only significant when the solenoid is moving. Obviously when it is not moving, who cares.

Q I am asking if it was computed, sir.

MR. GRAND: Asking if what was computed?

A Who cares what the response time --

Q Exactly. I think I misunderstood you before. I think you said it did enter into the computations of the reaction of the governor after the system had been armed.

A No, it doesn't.

MR. DeRENSIS: I think there is some confusion over arming and disarming.

Q Is there a branch which takes the solenoid response time in the formula with respect thereto out of the computation once the system has been armed?

A What do you define as arming the system?

Q When the microswitch has been tripped and when the current has been entered into the solenoid, when the solenoid has been fully retracted. After that point, is

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there a branch which takes the solenoid response time out of the computations until the system is rearmed, if indeed it is?

A Until the system is rearmed, no. When the solenoid is let go again, the response time comes back to play again.

Q In the interim period, does it enter into the computations?

A No.

MR. DeRENSIS: During what interim period?

THE COURT: I understand.

THE WITNESS: It is kind of going from zero to zero. Who cares.

THE COURT: Tell me, over the period of the simulation, from a speed down to where the car is almost stopped, does that become part of the computations?

THE WITNESS: If I understand you, your Honor, yes, it does. When the pressure switch open again, the solenoid goes back the other way. Yes. Whenever the solenoid is moving -- I will reanswer. Whenever the solenoid is moving in that time constant, it is a factor. Those computations of response are being made.

MR. BENBOW: Do you think we could break for lunch now, your Honor?

THE COURT: Sure.

(Luncheon recess.)

(AFTERNOON SESSION - 2:10 p. m.)

A N D R E L E O N A R D De V I L L I E R S,

resumed.

CROSS-EXAMINATION (CONTINUED)

BY MR. LAGEMANN:

Q Mr. DeVilliers, before we broke for lunch I think we were at the point where you said that the 20 millisecond lag in the cam gear was used throughout the computational process in your simulation; is that correct?

A Yes.

Q And in other words, then, it was used after the device had been armed and while the centrifugal governor was pumping the brakes; is that correct?

MR. DeRENSIS: I object to that because I don't believe there was any testimony to that effect.

MR. LAGEMANN: I am asking if --

MR. GRAND: No, you said, "In other words."

Q Is that the case?

A No, if I understand your question right. Are we referring to the cam gear or to the solenoid?

Q No, the cam gear.

A The 20 millisecond time constant in the simulation is operative at all times that -- for the deceleration and acceleration of the governor itself. So, yes, it is there

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all the time, with the proviso, of course, that it is on somewhere in the middle on the hill, you know, when it is pegged one end against the other, then the governor is just following.

But, whenever the governor is somewhere on this hill, whenever the pin is somewhere on that hill, that 20 millisecond time constant governs the action of the cam gear in that respect.

Q Was the 20 millisecond time constant used for both acceleration and deceleration?

A Yes.

Q Was the same 20 millisecond time constant used in all simulations?

A Oh, yes, yes.

Q And in all runs in each simulation?

A Yes. Everything that's here in evidence, et cetera, includes -- those runs all have that.

Q Isn't it a fact that the gear ratio which would, of course, determine the speed at which the cam gear is rotating, would have an effect on the time that it would take the pin to traverse the slope in the cam gear?

A Yes, it would. It would have an effect on the reacceleration and the -- it would have an effect on the acceleration of the cam gear itself, yes. But, again, the

gear ratio affects the acceleration of the cam gear itself, whereas the motion of the pin on the incline is related to the force between the pin and the cam gear, which, of course, is produced by the spring in the microswitch and by the acceleration-deceleration, et cetera, of the flying weights themselves.

Q Let me ask you this. Did the 20 millisecond time constant vary from gear ratio to gear ratio?

A No. It was used constantly throughout.

Q I believe this morning you stated, Mr. DeVilliers, that it would take longer for the pin to climb the incline on the cam gear than it would take for it to descend. Is that a fair statement?

A Yes, I would say that given all the second order effects, et cetera, that when deceleration is taking place, when the wheels are decelerating, then the behavior up and down the incline -- let me explain what I mean by up and down the incline. When deceleration is taking place, the pin will climb the incline.

Q Was that acceleration or deceleration?

A During deceleration. The kind of thing that -- the kind of effect that the second order or inertial effects could have there would be that it might overshoot a little bit.

For instance, maybe it might have a -- I mentioned this morning if a rapidly applied, not so high, magnitude deceleration was applied, say .45 G's or .46, if it is applied rapidly enough, it might overshoot .45 and go all the way up to .92, but then slide back down a little bit then, in a sort of oscillatory manner.

Q Was that oscillatory --

MR. DeRENSIS: He hadn't finished his answer.

THE COURT: Let him finish.

A This is all happening while deceleration is taking place. This is related to the amount of friction on the given cam gear, between the cam gear and the pin.

On the other hand, when acceleration is taking place, this basically -- this is what I meant, that the cam gear could pull right away from the pin, in other words, you would accelerate so fast, if it is a faster enough acceleration, -- I don't know how fast that it would have to be because I didn't get into that -- it might in fact suddenly just leave the cam gear, leave the little pin sitting there inspace, waiting for the spring in the microswitch to push the cam gear along the shaft to catch up with it.

That's not an area I have studied up -- that last item, how long it would take the microswitch spring to push the cam gear along the shaft, but that cam gear is awfully

light, and the lighter the amount of mass there in comparison to the spring rate, the faster such will happen.

So, what I am saying is that the hard core -- in absolute reality, there is a slight difference in the behavior during deceleration of the wheels and acceleration of the wheels. I deem that that's not overly necessary to consider in the modeling, because your primary concern was happening on the deceleration of the wheels. Once the pressure was down, the wheels are accelerated, so it cuts it off faster.

Q You say it cuts it off faster, do you mean?

A Breaks the microswitch.

Q We are talking about the system or I hope we were during this questioning -- we are talking about the system that has already been armed during which the operation of the microswitch is inoperative.

A Oh, okay, if you are assuming that, fine. Then it doesn't matter anyway, obviously. Then it really doesn't matter.

Q But the force of the leaf spring is still there, is it not, at all times?

A Sure. Anytime that thing is compressed that force is there.

Q Now, I believe you said something about overshooting or the possibility of overshooting of the pin in the cam gear. Was this overshooting you were referring to something that happened in your simulations or is it something that happens in real life in something like Plaintiff's Exhibit 3?

A I would say it is a possible happening in real life, and I might add a beneficial one to the operation of the system.

Q Is this something that you entered into your simulations?

A No, it is not in simulation. I only figured it out

recently.

Q When you say overshoot, overshoot with respect to what, the end of the slot in the cam gear?

A No, I just went through that. Let's imagine that the thing -- remember, now, when I said .92 G deceleration, that is implying if the pin was sort of gradually applied, you know, gradually, gently pushed up the hill, the amount of decelerative force just to hold it there against the spring force, and so this would definitely be during a very gentle application of the brakes, in which the pedal is pushed down harder and harder, and the deceleration -- that would be about the level it will trigger at. I am talking now in physical reality.

Q Mr. DeVilliers --

MR. DeRENSIS: Let him answer.

MR. LAGMANN: I thought he answered. Excuse me.

A It could be quite verbose.

MR. BENBOW: It could be loud. That would also be good.

THE WITNESS: I will try, sir.

THE COURT: Go ahead, finish the answer.

A Now, during a more rapid build up of brake pressure, and hence wheel deceleration, the inertial effects feasibly could get involved, and maybe .45 G's of deceleration applied

rapidly would be enough for the pin to ride up and actually go past what is apparently the .92 point that I mentioned earlier on the incline and close the switch, but then slide back down again, so you might have an on and off on that switch, a quite rapid one, I would say, you know, within 20 milliseconds each way.

Q I want you to remember that the switch is inoperative during the portion of the simulation we are talking about.

A Okay, if it is inoperative, I won't waste our time with it.

MR. DeRENSIS: I didn't hear the end of the answer.

THE WITNESS: I say if it is inoperative, I won't waste our time in describing that.

Q Could the pin rest at the intermediate point on the cam gear slope if wheel deceleration were in excess of .92 G?

A Yes, it could. My recollection is that .92 G is something around two and a half teeth -- I think that was right -- up the incline, and yet there are more teeth benind that so maybe at .96 or 1.0 G or something that still wouldn't be all the way up the incline and it might never get to the top. It might just come up there and rest or just below it, you know.

Q Mr. DeVilliers, you mentioned during one of your

long statements that there was an oscillatory motion going on here between --

A There could be.

Q Therecould be?

A I'm not saying. It has to do with the amount of friction that is there.

Q Did you simulate an oscillatory motion between the pin and the cam gear in your simulation?

A No. The first order -- let me explain something. The first and second order phenomena. We look at -- what is this, Exhibit number 134?

2-2 THE COURT: Keep your voice up.

MR. LAGEMANN: May the record reflect the witness is looking at the last or fourth page of Plaintiff's Exhibit 134.

A Any of those differential equasions there.

Q Excuse me, which equasions are those?

A The solenoid, the deceleration sensor and, as a matter of fact, the brake torque combined with Perma-Vac. They imply that the quantity and rate of change of the quantity are being considered in the equasion. If there are second order effects, then the rate of change of the rate of change is being considered, and the third order, the rate of change of the rate of change of the rate of change is

being considered.

This is a concept of a derivative in calculus.

Now, by representing something as a first order device, one is simply saying that the first rate of change is considered adequate to represent the device and its sort of inherent lags that might occur in time because of it. This is a matter of judgment. You know, in the field of control engineering, in particular, there are frequently cases which no one knows exactly what the order of the device is, is representing, and it is even determined experimentally, but it is very often done and successfully to just represent the device as a first order device because it is simpler, and it is simpler to get the experimental numbers to back it up, and good behavior is followed.

Q Mr. DeVilliers, is the operation of the governor and the cam gear and the pin a first order operation in fact?

A Not the governor part. That is second order.

Q It is second order?

A Yes. That is the full inertial effects are considered there. They are considered important.

Q I'm sorry to interrupt you --

A You know, I consider them important enough at least to look at.

Q Are there any second order equasions anywhere in

Plaintiff's Exhibit 134?

A Yes, there are.

Q All right, would you identify them, please.

A The differential equasion at the bottom of the second page, which is the principal equasion for the motion of the rotary switch under the action of the governor --

Q And what do you mean by rotary switch?

A The rotary valve.

Q And that formula defines the performance, I take it, of the rotary valve?

A Defines the -- well, let's look at the exhibit. Looking at the picture at the top of the exhibit, that is rather clearly a representation of the governor. All right. And it defines the motion of the quantity marked by the arrow X there on the picture at the top of the page, and that represents the motion of the rotary valve or rotary switch.

THE COURT: Keep your voice up so everyone can hear.

Q So the record is clear, does the second order formula which you have just identified start with the words --

A "Now let".

Q "Now Let"?

A Yes.

Q That is on page 2 of Plaintiff's Exhibit 134?

A Yes.

Q Are there any other second order equasions in that exhibit?

A Yes, the last page has one which is not involved in the simulation. It is the angular rate of change of the governor.

Q Would you please identify the beginning of that?

A It says "Hence."

Q And that is on page 4 of Plaintiff's Exhibit 134.

A Yes. It is the rotational equasion of motion of the governor.

Q Did you just say that that was not involved in the simulation?

A Not dynamically because of the essentially rigid connection between the rotation of the governor and the rotation of the wheels. Basically it defines the torque on the governor -- I think I said that -- there.

Q Starting on page 3 of Plaintiff's Exhibit 134 and carrying over to the top of page 4 of Plaintiff's Exhibit 134, there is a statement which begins, "Since this is a linear differential equasion," and then it goes on to describe certain characteristics of it.

Does that statement apply to all of the equasions

preceding that statement?

MR. DeRENSIS: I don't understand that question. If he is asking what this refers to -- or are you referring to the entire preceding portion of the document?

MR. LAGEMANN: I am asking if it does.

A I will have to take a little look there. I have forgotten.

MR. DeRENSIS: I still don't understand the question.

A No, that does not apply to all preceding equasions on the document. I might add that what is on this paper is not only what is in the simulation, but a bit of an analysis, a bit of a little study of the behavior of the governor. The equation that is in the simulation is up near the top of the page. It is the non-linear, more complex version.

Q Let me see if I understand you. Are you saying that there is information data and/or equasions in Plaintiff's Exhibit 134 that were not entered in the simulation?

A That is a loaded question.

THE COURT: There are some of them that are explanations of preceding ones. Is that correct?

THE WITNESS: Yes, derived from preceding ones. The fundamental equation of motion which is on this page is in the simulation.

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THE COURT: All right.

THE WITNESS: I then simply studied that fundamental equation of motion and did what we call linearize the thing, and I won't go into all that, other than to say that sometimes one can look at a linearized equasion of motion and see behavior inherent in it that is not inherent in the non-linear version, but because we have a digital computer to work with, we don't have to worry about the equasion being harder to solve. We put the worse case in.

Q Mr. DeVilliers, I am going to give you the original of Plaintiff's Exhibit 134 and I am going to ask you to mark for us on this original exhibit, with the Court's indulgence, which were the formulas which were used or entered into the computer in the simulations that you ran?

THE COURT: All right, what are you marking them with?

THE WITNESS: Pencil.

THE COURT: Sure, use the pencil.

THE WITNESS: Okay.

(Witness complies.)

Q Just so we are certain, why don't you put the word "entered" by the formulas you are denoting?

(Witness complies.)

A All right.

Q Have you completed marking the exhibit?

MR. LAGEMANN: Let the record reflect there is a formula denoted as entered on page 2 of Plaintiff's Exhibit 134 --

A I was talking about this governor, this stuff.

MR. LAGEMANN: Let the record reflect that when the witness said "this stuff" he was referring to the final 3 formulas on page 4 of Plaintiff's Exhibit 134.

THE COURT: Mr. DeVilliers, before you go, you mentioned the governor wheel there in your reference to the formula that you marked off, right?

THE WITNESS: Yes.

THE COURT: Were other formulas in that exhibit ever used in the simulation in connection with anything?

THE WITNESS: If I understand you correctly, the answer to that would be no. The first one that I marked is entered. The principal equasion, motion of the governor, is in the simulation. The others were for my own -- the derivations beyond that were for my own education.

Q Turning to page 4 of Plaintiff's Exhibit 134, I ask you to look at the three formulas you indicated which were entered. Are all of those formulas linear differential equasions?

A Yes, the last three are rather obviously -- I am

sorry, it is not obvious at all. The last three were solenoid deceleration center and brake torque, combined with Perma-Vac, yes, those are linear differential equasions as shown there.

Q Showing you the formula that you marked on page 2 of Plaintiff's Exhibit 134, I ask you if that formula is a linear differential equasion?

A Oh, that is not a linear differential equasion.

Q What is it?

A Not linear.

Q Mr. DeVilliers, how fast did the Perma system cycle during your simulations?

MR. DeRENSIS: I object to the word "cycle." I believe there has been testimony there was no cycling. There was cycling only at low speeds. So the question has assumptions in it that are not stated.

THE COURT: That's my recollection also. Do you want to restrict it down to low speeds?

A Was there a periodic variation of brake pressure during the operation of the Perma device in your simulations?

A Yes.

Q What was the period of variations in brake pressure that the simulations said that the Perma system provided?

A I am glad you rephrased that. The fact that there

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is a second order differential equasion involved there --

Q I think let's --

A I don't remember it precisely. You have the tapes. You can look at it. Your experts.

Q The tapes or printouts, what do I have?

A Printouts.

Q Let me give you the printouts and you tell me. Actually, before we do that --

MR. DeRENSIS: I think he should be allowed to complete the answer --

THE COURT: He wants the printouts.

A I don't exactly remember it. That's the problem.

Q Incidentally, have you plotted out any of these printouts?

A No, I didn't plot them. In my mind I plotted them, but --

Q Never on paper?

A Not these, no.

Q You didn't, for example, plot out the slip values of the various wheels during different stops?

A No, I just printed them. It could be, I admit.

Q Have you previously calculated the frequency of brake pressure variation caused by the operation of the Perma device?

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A Have I previously?

Q Calculated.

THE COURT: Previous to what?

MR. LAGEMANN: To now.

A The simulation does that for you.

Q Did it come up with an answer that told you how often it did it in simple numerical form?

A Let me look and tell you.

MR. LAGEMANN: While he is calculating, let the record reflect --

THE WITNESS: Calculate? Just look.

MR. LAGEMANN: -- that the witness is looking at the first printout page on Plaintiff's Exhibit 127.

(Pause.)

A (Continuing) I see a phenomenon four to six cycles per second.

Q Four to six cycles per second?

A Yes.

Q And that would be --

A This is a very low -- it isn't even a significant oscillation. It is during the governor portion of the cycle, of the stop. This is the other form of oscillation, as was mentioned, at low speeds. I guess we could look at that further.

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Q This is during normal functions?

A Governor, yes. That's just a dynamic sinusoidal type of oscillation.

Q You say that --

THE COURT: Wait a second. Hold on. Sinusoidal?

THE WITNESS: Like a sign wave.

Q Did you say that this variation was sinusoidal based on what you saw in the printout?

A Yes. I was just observing maximums and minimums of pressure noting roughly how far apart they were in time.

Q And you say that the variation occurred approximately four to six times per second?

A. That's what I noticed there.

Q Would the rate of that variation change in the Perma system under different road co-efficients of friction and at different speeds?

MR. DeRENSIS: Could we have one question at a time?

THE COURT: Let's try it under different road co-efficients of friction.

A Yes, I would expect it to be -- assuming now it is the governor that is functioning and not, as I am saying, it were up -- I am assuming that we are between the maximum and the minimum speeds as defined earlier of the governor --

Q When the system is completely --

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MR. DeRENSIS: Let him finish his answer, please.

THE COURT: Let him answer.

MR. LAGEMANN: I was just trying to speed it up, your Honor.

A The oscillation I picked off there is basically tied to the dynamics of this little governor itself. It does not know what kind of road it is on. The type of oscillation which would depend on the road would be in the more low speed areas in which the rate of spin up of the wheel was more involved in this pressure rise and fall rather than simply the oscillatory dynamics of the governor. It would have some effect.

You know, it is one big dynamic system and all of the things are tied together. I guess I would answer it that way.

Q Let me see if I have you right. You are saying that the basic oscillatory phenomenon or the way the system functions is strictly a function of the opening and collapsing of the governor and is not necessarily a function of the road?

A No. I am qualifying that slightly. One can't -- you know, this is one -- you know, the combination of the car and the road and this device are one dynamic system. But, I think that principally the period of oscillation that

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I described here a minute ago is due to the internal dynamics of the governor as much as anything.

3-2 But, there are certainly cases, you know, the road co-efficient does have something to do with how fast the pressure is going to rise and fall, somewhere in the skid control stop, any skid control stop.

Q How much variation do you expect, as an expert in anti-skids, to find in the oscillatory rate of the governor, let's say between stops on .75 mu surfaces and stops on .15 mu surfaces?

MR. DeRENSIS: I object to that because from the question it doesn't appear to be talking about the Perma device and is asking him to speculate in general about anti skid devices.

THE COURT: Assume we are talking about Perma device.

Q Very well, let's make it clear. Responding to that question, we are talking about the performance of the Perma device as you simulated it.

THE COURT: Answer it now.

MR. DeRENSIS: We are no longer asking about expectation, we are asking about how it in fact worked?

THE COURT: No. How the simulation comes out, how he would expect the simulation to come out. Go ahead.

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A It wasn't how I would expect it to come out. I really don't know.

MR. GRAND: He has results in front of him.

THE COURT: Did you check the simulations? Do you have one at .15?

Q Why don't we take the 25 mile an hour stop.

MR. DeRENSIS: I have another objection, and that is that there is no foundation laid that we are talking about the same type of cycling. I think there is one kind of cycling going on and possibly a second kind of cycling.

THE COURT: I understand the question.

MR. LAGEMANN: The question was, let's make it clear, we are not talking about cycling off the pressure switch. We are just talking about cycling caused by the governor. That's it.

A I am glad you made that distinction.

Q I thought I had before. Excuse me.

A It was at one point.

A Let's make it a continuing distinction.

A On this 25 mile an hour stop.

(Pause.)

A (Continuing) Sometimes you can't tell whether it is cycling on the pressure switch or not, when looking at the simulation. You can't tell whether the governor is doing it

or not.

THE COURT: All right, let's see what you can do, though.

THE WITNESS: This one appears to be cycling about 10 times a second.

THE COURT: When you say "this one," which one are you referring to?

THE WITNESS: 25 mile an hour stop on .15 road, and that is when the speed is down to, oh, the 20 miles an hour area.

MR. LAGEMANN: Let the record reflect that is Plaintiff's Exhibit 127 that is being referred to.

THE WITNESS: I think that there is probably some pressure switch-microswitch activity taking place there, but that is just an estimation. As I say, it is difficult just from looking at the results, unless one chose to print all of that stuff out, which I didn't see any point to doing. I just wanted to know whether the thing worked out or not.

Q Excuse me. What didn't you print out?

A Well, you know, any computer program has got immense amounts of data, you know, internal to it. It's like a big machine with a glass wall around it and you look at what is significant.

Q In other words, is there information that was

derived from the equasions and formulas and inputs that you put into this glass walled room that are not printed out in these exhibits?

A No, no. It is information which is, you might call it, intermediary. I am trying to think of --

THE COURT: In other words, there are intermediary steps in the solution of the problem, and you didn't and for these intermediary step solutions; is that correct?

THE WITNESS: Yes, to print out. I think we are saying the same thing. For example, I can't look at this printout and on a specific simulation decide whether we have pressure -- in all cases, most of the time, that you can tell whether it was pressure switch or microswitch cycling, and most of the time when it is definitely just a governor, you can tell that too. I would have had to look at other things that are happening in there at the same time to tell them.

Q How can you tell that?

A You would have to go and write the program differently or write the printout, the output of the program.

THE COURT: In other words, you would have to call for the answers of the intermediary problems; is that right?

THE WITNESS: Yes. It's like -- you know, you hear the word EDP, electronic data processing, just because

you work on a data basis you don't get every piece of data the thing has everytime you look at it. You get what you want out of it, you know, the significant variables.

Q I believe you stated before that the unit did cycle off the pressure switch in the arming device. Do you recall testifying in that regard?

A I think I testified in that regard.

MR. DeRENSIS: I don't understand the question, whether he means in general or just the last answer.

MR. LAGEMANN: In general, on direct.

A I am quite sure. I remember testifying in that regard.

Q How did you know it did it?

A How do I know it did it?

Q Yes.

A I knew ahead of time to expect it just from studying the system and how it works, and I have testified earlier as to which documents, as well as looking at the hardware, which documents I studied as well as to look at the hardware.

Q Did Mrs. Perrino tell you that it was going to do this?

A No, Mr. Perrino --

MR. DeRENSIS: Did he finish his answer?

A (Continuing) I don't know whether Mr. Perrino ever

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mentioned it or not, but it's abundantly clear that it can happen, and I expected it, and when I see it occurring, you know, apparently in the simulation, I never even questioned whether it was or was not because I expected it.

Q You say it apparently happened in this simulation. How do you know it apparently happened?

A Well, when the speed gets down at such a point that the governor can't expand any more, the simulation simulates the solenoid and the dynamics of the governor even at low speeds, that it has to be able to happen.

Q Mr. DeVilliers, did you look at the numbers inthe printouts which are Plaintiff's Exhibits 127, 128 and 129 to ascertain whether or not there was pressure switch cam gear cycling going on before you said that this in fact occurred?

A I looked at the numbers and concluded that it was going on, just from the behavior of the numbers. The one I just testified to herea minute ago is one in an area that I think it probably has begun to occur, but I am not quite sure. I think it probably is occurring at that point.

Q What line of printout data were you looking at, sir, when --

A I was looking at the rear wheel brake pressure on that 25 mile an hour stop that you asked me to look at.

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Q Rear wheel brake pressure, sir?

A Yes.

Q You mean brake torque.

A Brake torque, same difference in this case. Applied brake torque.

Q Mr. DeVilliers, when the unit cycles off the pressure switch, does it cycle at the same frequency as it does when it cycles off the operation of the centrifugal governor?

A I don't know. I would expect that -- I would expect not, because different phenomenon are occurring, but I don't think I would expect it to be exactly the same frequency.

Q Would the amplitude of variation in either brake pressure or brake torque be different when the unit cycles off the pressure switch?

A I would expect it to be different.

Q Did you analyze this in the printouts?

A I observed it.

Q Did you analyze it, sir, other than observing it?

A What do you mean by analyze it? I looked at it, saw it is there. It seemed acceptable to me.

Q Mr. DeVilliars, I do not have your faculty for analyzing numbers. I wonder if you could, during the evening make a plot for us of brake torque during the 60 mile an hour

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stop on a .75 mu surface and bring it to Court tomorrow and then we could analyze pictorially, for my benefit and perhaps the Court's, what cycling frequencies were and what happens to brake torque, when we cycle off the pressure switch.

MR. DeRENSIS: Your Honor, I object to that. He has two experts in the courtroom. Why should --

THE COURT: I am quite sure it is quite easy to make a plot, for anyone to do it, right?

THE WITNESS: I would say so.

THE COURT: All you need is a piece of graph paper.

THE WITNESS: Yes, and an evening you are willing to spend for a while.

MR. LAGEMANN: Your Honor, we have some plots, and if you are willing to let us use those with this witness --

THE COURT: Ask him to take a look at the plots, compare them to his printouts and see it -- okay?

THE WITNESS: Sure, as long as it is based on these printouts.

THE COURT: How long would it take?

THE WITNESS: If they have already looked at these printouts and done some plots, right as soon as they put it in front of me we can start looking at behavior.

Q Mr. DeVilliers, I am handing you a plot of a stop from 25 miles an hour on a .15 mu surface utilizing a 24 to

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one gear ratio. Why don't you initially, sir, check the accuracy of that plot against the printout,Plaintiff's Exhibit 127, I believe --

THE COURT: Mr. Clerk, mark this as Defendant's Exhibit. Mr. DeVilliers, how long will it take you to check out these two things, four or five minutes?

THE WITNESS: Yes, I believe that would be adequate. I mean look at them closely.

THE COURT: You have to look at them closely or else you cannot really -- I want you to look at it closely.

(Defendant's Exhibit 65 was marked for identification.)

xxx

(Recess.)

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THE COURT: All right, Mr. De Villiers, have you had an opportunity to review this plot against your computer printout?

THE WITNESS: Yes, I have, along with Mr. DeRensis, been looking at certain of the plotted points, comparing them with numbers, and there is match in certain places. However, near the middle of the plot it becomes difficult to tell which curve you are on because they get mixed up. So I could not attest to the complete accuracy of this. Had it been plotted with two different colors of pen or something then it would be easier.

For instance, your Honor, you're out in here some place; it's kind of hard to tell which one of these original curves you are on. So in terms of the absolute accuracy of it, certain of the numbers, particularly in the earlier part of it, were correct.

THE COURT: All right, but --

THE WITNESS: And at the end. This looks right; this looks essentially right. I didn't look at every last number. At the beginning (indicating).

THE COURT: And this part (indicating).

THE WITNESS: Yes, and the qualitative behavior, up and down, up and down, at the end is what seems to be happening, but I can't tell in the middle.

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THE COURT: You can't tell in the middle?

THE WITNESS: No. Only qualitatively.

THE COURT: Do you want to ask about the beginning and the end?

MR. LAGEMANN: Actually, your Honor, we had hoped to be able to ask about the beginning, the end and the middle.

I have a suggestion which might cure the problem. This is a Xerox, as your Honor can see. We have the original. It is plotted. We do not have it in the courtroom, unfortunately. We have just sent for it. We didn't think we would be getting into this.

THE COURT: Can you go on to something else?

MR. LAGEMANN: I was suggesting I go on to something else and provide a plot tonight which can be verified and actually we can get into this in the morning.

THE COURT: Okay.

BY MR. LAGEMANN:

Q Mr. De Villiers, looking at Plaintiff's Exhibit 5-A, did you simulate this vacuum hose to the engine manifold in any respect?

A All of that is implied in the time constant used in the first order representation of the Perma-Vac brake combination. Again, we represented the Perma-Vac and the brakes combined system, again, with a first order representation

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of the rise and fall of the brake torque.

Q As I recall, you said earlier -- tell me if I am correct -- that this time constant was based upon your experience in simulating the Kelsey-Hayes actuator; is that correct?

THE COURT: In part.

A In part. I think that is a good way to put it. It is a reasonable number, you know. The Perma-Vac device by inspection is a device representable in a first order manner, so it is necessary to determine a time constant within this first order representation, and it is reasonable -- it is a reasonable number, and it is in consonance with what happened with Kelsey-Hayes' devices.

Q What was the response time of the Kelsey-Hayes actuator?

A Exactly, I don't know. However, it would cycle at about six times a second, as I recall, and in one of our technical papers -- the Riorden paper that is here someplace -- there is a plot, a pressure output plot of the Kelsey-Hayes actuator.

Q Is it your testimony that the Kelsey-Hayes actuator would --

MR. LAGEMANN: Withdrawn.

Q --that the Kelsey-Hayes actuator's response time was

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approximately 30 milliseconds?

A The time constant, yes, I would estimate it was in that area.

Q Where was the Kelsey-Hayes actuator located when installed on an automobile vis-a-vis the manifold?

A I believe it was under the hood. That's about as best -- in fact, I think it depended on the car. For instance, on the Lincoln Continental there was a large amount of plumbing anyway under the hood; it was difficult to find a place for it, but on the Thunderbird, they can be more liberal with their location of it.

Q Let's take a look at Plaintiff's Exhibit 121 again, where on page 6, figure 3 -- I'd like you to look at figure 3, if you would, for the time being. Does figure 3 depict that the actuator was mounted in the Lincoln Continental sort of under the fire wall and behind the front suspension of the automobile?

A I think that in reality, if you opened the hood, with the engine in there, you would be able to see that there. I am not sure how absolutely accurate that picture is, but --

Q Let's assume it is not accurate. Does that show the general location of where it was located?

A Yes, it is somewhere under the hood. That is the best I can say. Somewhere near the engine, next door to it.

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Q It was next door to the engine?

A Yes, or next to the engine. We don't have doors involved.

Q Did the Lincoln Continental have dual exhaust manifolds?

A I don't know that answer. I think -- well, I don't kno

THE COURT: All right, if you don't know, say you don't know.

THE WITNESS: I don't know.

Q Do you know of any V-8 configured automotive engine that does not have a manifold on each side of the engine?

A Oh, I'm sorry, you know, when you said, dual exhaust manifold, my immediate -- I thought of dual exhausts. Yes, of course, there were two exhaust manifolds on the car, one on each side. I'm sorry.

Q Was the Kelsey-Hayes actuator tapped into the nearest exhaust?

MR. LAGEMANN: Withdrawn.

Q How long approximately was the vacuum connection between the Kelsey-Hayes actuator and the intake manifold?

THE COURT: What car?

Q On a Lincoln Continental, 1968.

A You'd better ask Kelsey-Hayes that. I don't know.

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Q Take a guess.

MR. DeRENSIS: If he knows.

THE COURT: He says he doesn't know. I don't want any guesses.

Q In the Kelsey-Hayes device, did vacuum pass through a rotary valve?

A No, it was -- let me think what it was. It wasn't a rotary valve. It was just an open and shut --

Q Was it a poppet valve?

A I think it would be a poppet valve.

Q Where was the poppet valve located?

A In the actuator some place.

Q In the actuator itself?

A Let's see if we have a picture here.

Q Yes, we do.

MR. LAGEMANN: May the record reflect that the witness is on page 11 and is looking at figure 10 which is entitled Actuator Schematic Diagram.

MR. DeRENSIS: You mean figure 18.

THE WITNESS: Figure 18, yes, that is what it is.

A Yes, it is located in the actuator, on the end of the solenoid.

Q In the Kelsey-Hayes system as marketed in 1968, or, indeed, at any other time, did vacuum have to pass through

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the command module?

A No; that is an electronic device; it doesn't need any vacuum.

4 pm

Q Arriving at your 30 millisecond time constant, did you take into account air flow through the port holes in the rotary valve?

A In modeling from a device determining time constants, I used what I considered to be a reasonable number. I didn't worry about the detail design, construction of that device, other than to decide that this is a vacuum brake actuator.

The ports are open to allow air in and out. To do the kind of thing that you are talking about there is -- I am not even sure they do it in a design program. They might do some rough calculations, as often as not they will do some calculations and then start experimenting at test stands.

It could be -- I don't know whether you realize it, but the fluid mechanics involved there, to simulate that precisely is more complex than this whole simulation.

THE COURT: Okay, gentlemen, you will have to put up with me for a minute.

(Recess.)

MR. LAGEMANN: Your Honor, in the interim we have marked as Defendant's Exhibit 657A the original in two colors, which, since we are going to embark on another subject, I am just going to hand to Mr. DeRensis now and he and MR. DeVilliers can check it over during the evening.

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Q As we were leaving, I believe you said that you did not calculate any variations in air flow through the holes in the rotary valve; is that correct?

A No, I didn't go into that. As I mentioned -- if you will allow me to give a slight story --

THE COURT: No, don't give a story. It is a very involved fluid dynamic problem; is that correct?

THE WITNESS: To do it very precisely, the kind of thing you are talking about.

Q Could it be empirically measured?

A Oh, yes -- well, let me think before I am too positive. Yes, one could take any test device like this and do measurements on it.

Q Device like this, something like --

A The Perma-Vac.

Q We are talking about the rotary valve?

A You can put a vacuum source on one end of it, sure. You could put a vacuum source on one end of that and experiment in the lab with it.

Q And obtain data?

A Yes.

Q Such data could, of course, be entered into a subsequent simulation?

A It is frequently done that way.

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Q In the industry is it frequently done that way?

A Certainly, because, you know, in the industry simulations and development programs go hand in hand, in many cases. One does simulations to find out where one is going to go. Then one goes ahead and makes hardware. Then one does his comparisons and, what's the word, extrapolates.

Q You are a mechanical engineer, are you not?

A Yes.

Q Are you technically competent, Mr. DeVilliers, to conduct such experiments?

A Let's see, how would I put that? If I had a laboratory, equipped laboratory, and a technician or two to assist me to make my life easier, if, for instance, in my present employment a similar task came up, I am sure that I could get it done as an engineer.

Q Incidentally, where did you run this simulation? Was it at MIT?

A No, I ran it for the most part in the computer at the AVCO Computer Services in Wilmington, Massachusetts. It's a part of the AVCO Corporation. They have a large computer facility from the space program days. They sell time on it.

THE COURT: Did you physically do it there or did you use the terminal --

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THE WITNESS: I happen to work and live near the place, so I can just go there.

Q Where was the remainder performed? I believe you said--

A No, let's put it this way. I ran the program a little bit even on the company computer just for tests, bench marks, but for the simulation we have done here, all the runs that were submitted, that was all done at AVCO. Obviously, I couldn't use the company computer for anything but just to see how the program was running, compiles, and that kind of thing.

Q Directing your attention again to the rotary valve as depicted in Plaintiff's Exhibit 5A, at certain vacuum levels, meaning certain higher vacuum levels, would it be likely, from your experience as an mechanical engineer, to get supersonic air or vacuum flow through that valve?

MR. DeRENSIS: I object, first of all, to "higher vacuums." We don't know higher than what. Secondly, we have some phrases there that are not identified.

THE COURT: You mean lower vacuum, I assume.

MR. LAGEMANN: Higher vacuum.

THE COURT: Do you mean less vacuum or more vacuum.

MR. LAGEMANN: More vacuum.

THE COURT: If you have more vacuum --

MR. DeRENSIS: More than what, though?

THE COURT: I don't know.

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Q Let's assume, Mr. DeVilliers, that you had --

THE COURT: The former question is withdrawn?

MR. LAGEMANN: I withdraw that, excuse me.

Q Let's assume that you had a vacuum availability of more than 25 inches of mercury at the manifold of the automobile and let us assume that the rotary valve turned fully. Would there be a supersonic air flow through the port hole in the rotary valve?

A I can't say offhand. You are getting into a gas dynamic matter, and I am not that current on gas dynamics. I can go and look at a text book and find out. Obviously somebody is here.

Q Did you enter the length of this atmospheric pressure and vacuum hose into the 30 millisecond constant for Perma-Vac response?

A No. What length am I going to use, if I did?

Q Was the length of that hose variable in different insulations of the Perma Anti-Skid Device in automobiles, if you know?

A I don't know, but I am sure that it could be.

Q Would the length of that hose have any effect on the response time to the Perma-Vac?

A Yes, I think it would.

Q While we are there, would the length of the vacuum

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hose to the engine manifold have any effect on the response time of the Perma-Vac?

A The length of the hose to the engine manifold?

Q That's the hose on Plaintiff's Exhibit 5 which is labeled vacuum hose to engine manifold which connects the anti-skid unit to the vacuum source at the engine.

A Yes, I would think that would have some effect on it.

Q In arriving at your 30 millisecond response time figure, did you take into account the length or, rather, the distance that air or vacuum would have to flow from the manifold, through the rotary valve, through the atmospheric pressure and the vacuum hose, until it got to the rear of the Perma Vac cam?

MR. DeRENSIS: Hasn't this been answered already, at least twice?

THE COURT: I think he said no.

THE WITNESS: That would have to be my answer.

THE COURT: All right.

A Again, those are internal details of this system which are variable with the design. I took my experience in the literature, some of which is in front of me that I can look at for reference, and I decided, okay, 30 milliseconds is a reasonable number. It may not be right on that, it may

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be more, it may be less.

Q Was the length that the vacuum had to travel in the Kelsey-Hayes system variable in design?

A I think so, but I am not positive, in terms of where the thing was located relative to the manifold. If at any time they varied it, if they put it in a different place on a different car, it certainly would be.

Q Let's take Lincoln-Continental. Was a Kelsey-Hayes system installed at the factory?

A Yes, I think it is.

Q Mass produced?

A Yes.

Q Were the actuators always located in the same place?

MR. DeRENSIS: On the same car, are we talking about?

MR. LAGEMANN: No, on different cars.

A Of course.

Q Was the vacuum source always at the same place?

MR. DeRENSIS: Again, in the same car?

MR. LAGEMANN: The same series of cars.

MR. DeRENSIS: If he knows.

THE COURT: Go ahead, answer it.

A I will put it this way. I don't see any reason for it not to be. That would drive an assembly line nuts.

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Q Was the length that the vacuum would have to travel from the manifold to the Kelsey-Hayes actuator a known quantity?

THE COURT: On Lincoln-Continentals?

MR. LAGEMANN: On Lincoln-Continentals.

A Sure it was known. Whether anybody worried about it, I think they -- I am sure they worried about it in designing the particular actuator, if they varied any sizes of components or not, but I never heard it spoken of.

Q Did Kelsey-Hayes ever calculate or experiment to determine response times of the actuator?

A In my experience, they did not. The calculations would have been done by the designer of the actuator, and these would specifically have been the type of calculations one makes to size, the first unit one makes, the first prototype.

Then they may have several prototypes made and they would go out into a laboratory and test and measure and decide whether to change the size.

Q In figuring out response times at Kelsey-Hayes, did the Kelsey-Hayes engineers, if you know, take into account the length of vacuum hose from the manifold to the Kelsey-Hayes actuator?

MR. DeRENSIS: Hasn't that been answered, your Honor.

MR. LAGEMANN: I don't believe so.

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THE COURT: I don't think so.

A If it was done, it was done by the designer. That's the best I can say. I didn't do it. I didn't even do that kind of work there.

Q When you decided to use a 30 millisecond time delay in Perma Vac response time --

A I didn't use a 30 millisecond time delay. I used a 30 millisecond time constant there. It is not the same thing.

Q Did the time constant represent the period of time it would take the Perma Vac to respond to a signal?

A The time constant in general, as I testified earlier, is the time for a step chain in the input to the actuator, it is the time for it to move to roughly 63 percent of that demand value. One reference time to that is right in Kelsey-Hayes' page 13 of their paper.

THE COURT: Which is --

MR. LAGEMANN: Plaintiff's exhibit 121.

A (Continuing) This actuator pressure dump and build up plot.

Q While we are looking at that actuator dump and build up plot, which is figure 21 on page 13 of Plaintiff's Exhibit 121, I note that there is an unusual configuration in the right-hand chart here which indicates that pressure build

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up and pressure dump occurred at different rates.

MR. DeRENSIS: I object to the characterization as "Unusual." If you want to point something out, I think you should point it out.

A That was to solve a problem they had.

THE COURT: Let me rule on the question. Answer it now.

A (Continuing) That was to deal with a problem which they had, as I recall, reading in this paper. That is not anything like the problems that we incurred in the Perma device.

Q Would one of the effects of the stepped or staged build up, as illustrated in the right-hand corner of that figure, be to maintain the wheels closer to the ideal 15 percent slip ratio for a longer period of time.

MR. DeRENSIS: I object to "closer." We don't know closer than what? What is the 15 percent ideal that he just mentioned now?

MR. LAGEMANN: The witness has already testified that 15 percent was the optimal --

THE COURT: As I recall, he did. Is that your testimony, that the ideal was around 15 percent?

THE WITNESS: About that, yes, although I also testified that while the ideal may be 15 percent, 20 percent,

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it is better to be the right of it if you are going to be one place or the other.

Q The question, then, sir, is in which of these two configurations which you see before you in figure 21 on page 13 of Plaintiff's Exhibit 121 would the slip be maintained closer to 15 percent during pressure build up?

A They apparently figure that the one on the right would do it.

Q That was Kelsey-Hayes' figure?

A Yes, but that actuator was working in a different environment to what this one was working in. It was working with a different sensor. It was either full on or full off.

If I remember correctly and without going back and reading all the paper, and I vaguely remember association with it, that decrease of the slope of the pressure build up was to keep from putting the -- having the brakes go back on too quickly. It was allow them to spin up a little farther before the went down again.

But this actuator doesn't even work in this manner.

Q Would Perma Vac produce such a response?

MR. DeRENSIS: What does "such" refer to?

Q The response as illustrated in the right-hand portion of figure 21 in Plaintiff's Exhibit 121.

MR. DeRENSIS: I object on the grounds of relevance.

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What does that have to do with this case?

THE COURT: I sustained the objection. He just testified that the actuators are entirely different. There is no necessity in Kelsey-Hayes to put it in that form.

MR. LAGEMANN: Your Honor, I believe it is relevant, and I believe it is relevant because of the Plaintiff's pretrial memorandum. They have claimed it is their contention that the Kelsey-Hayes device and the Perma Anti-Skid Device were essentially similar and comparable.

Seeing as how that issue has been put in the trial, I think it is a perfectly relevant question.

THE COURT: I believe it is similar, it is comparable. But when you get down to the little nitty-gritty user, like this, you are getting pretty far away from just similar and comparable. They are not totally the same configuration. Is that correct, Mr. DeVilliers?

THE WITNESS: Yes, sir, yes, your Honor.

MR. BENBOW: But, your Honor, isn't it fair that we should be permitted to explore those differences and see if they are itty-bitty, as you say, or whether they have some greater significance?

5-3 MR. DeRENSIS: Your Honor, we just had an answer from the witness that --

THE COURT: I am quite aware of it.

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Q Mr. DeVilliers, did I understand you to say previously that you derived the 30 millisecond time constant from your experience at Kelsey-Hayes?

A I selected it, as I said, it is a reasonable number I looked at this plot for reference values back to my experience.

Q Was that experience based on the Kelsey-Hayes actuator?

A On the actuator? My experience at Kelsey-Hayes is actually sitting there, working there. Their actuator cycled in the sixty ten cycle per second range. Roughly the way I read the Bendix did. They were not that unalike.

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Q Where did you read that Bendix cycled at 6-7 ~~67~~ cycles per second, sir?

A I either read it in the paper or I heard it once in Michigan at a technical meeting one night, in which some guy who worked at Bendix Research Laboratory was discussing it. That is where I get that from, discussing their system, even though somebody from Kelsey was in the audience.

Q Mr. DeVilliers, in arriving at your 30 millisecond time constant did you take into account any frictional effect between the hydraulic plunger and the walls of the hydraulic fluid cylinder?

A I had them in my mind.

MR. DeRENSIS: That has been answered already. I think we got a description of how he arrived at it and how he took it into consideration. This can go on endlessly.

THE COURT: I believe he started a new line. Let's see if it is. I will permit it. Let's go.

A I acknowledged in my mind that it was there, and I just -- sure, it is going to have some effect, but I don't know how much. That again is a subject for a test program. The only way one is going to tie it down and find out exactly what that thing is is to go out and test it.

Q Did you go out and test it?

A I was in no position to go run a test program on

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the Perma system, believe me.

Q Why were you in no position to run a test on the Perma system?

THE COURT: Oh, we have been through that. That I know.

MR. LAGEMANN: I don't think so, your Honor.

MR. GRAND: At great length with Dan Goor, the question of availability of devices, of cars, of units, of money, finances.

That is not what Frank Perrino hired him to do. We can go on and on.

Q Were you ever told that no units would be available to you for testing purposes, Mr. DeVilliers?

A No, but it wasn't too hard to assume. Even if they were available, as I think I have testified to, was retained to study the fundamental viability of this system.

Q Does the system include a Perma Vac --

MR. DeRENSIS: Let him answer the question.

A I did study that viability. I did via analysis and simulation and my experience, and I came up with my conclusions. Obviously I wouldn't be here to --

MR. LAGEMANN: Your Honor, at this time --

Q I'm sorry, did I interrupt?

A I got the data. I used literature, I used Lack-

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ground, and I got reasonable numbers. I think that the exact values of them are even of questionable relevance.

Q Did you use literature in the Perma Vac response time?

A Oh, no, not in -- this kind of literature, you know (indicating).

Q Did you use that kind --

THE COURT: He pointed to --

MR. LAGEMANN: Plaintiff's Exhibit 121.

A We had to be a bit ~~objective~~ subjective, obviously. What else could one do?

MR. LAGEMANN: Your Honor, I have here two letters which indicate that our firm sent on two occasions Perma units to counsel for plaintiff, and I would like to have them marked as Court's exhibits, whatever the special number is.

THE COURT: Defendant's exhibits.

MR. LAGEMANN: All right. What are the next two numbers?

MR. DeRENSIS: I object.

MR. GRAND: Let them mark whatever they want to.

MR. DeRENSIS: Okay.

(Defendant's Exhibits D-658 and D-659 marked for identification.)

xxxx

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MR. LAGEMANN: Your Honor, I would like to note at this time that prior examples of correspondence between counsel in this case have been marked as Courts exhibits, and simply taken in on this basis.

I would ask again that these letters be taken in as Courts exhibits.

MR. GRAND: Are you offering them?

MR. LAGEMANN: As Courts exhibits, yes.

MR. GRAND: You are not offering them as your exhibits?

MR. LAGEMANN: I would like to offer them as Courts exhibits.

THE COURT: Look, they are marked as Defendant's Exhibits. What's the difference? I read all the exhibits anyway.

MR. LAGEMANN: The problem is, your Honor, that the author of these letters is no longer with the firm. I hate to call him back to introduce them.

THE COURT: Let's see them.

MR. GRAND: Your Honor, I think maybe you ought to look at them before you rule on them. I don't know what point they are intended to prove. I object to them. They reflect the transmissions of a couple of units to our firm

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on conditim that they not be used in any way that would risk bodily harm to anybody, so to preclude anything like road testing.

In addition, I am perfectly prepared to testify, your Honor, if you would see fit, that I am far more ambitious in terms of spending my client's money or the lack of it than they are able to afford, so I really don't see what relevance these exhibits have.

THE COURT: Let me see them.

MR. LAGEMANN: After your Honor is through reading them I could address Mr. Grand's point if your Honor wishes.

THE COURT: All right, go ahead.

MR. LAGEMANN: It is our position that these are highly relevant. They are relevant as to what plaintiff could have done in relation to testing the device.

To begin with, the best evidence possible, as they have already admitted, would be an actual road test. Failing that, --

MR. DeRENSIS: I object to that.

MR. LAGEMANN: Let me finish.

MR. GRAND: It is precluded by the documents themselves unless they be done by dummies.

MR. DeRENSIS: I would like to object to the statement.

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MR. LAGEMANN: I would like to finish my statement.

THE COURT: I only take argument one at a time.

MR. LAGEMANN: Failing that, your Honor, the best simulation evidence, as good as that is, would be obtained by testing certain components of the device to figure out what time delays in actuations actually, in fact, were in the hardware instead of assuming these.

We feel if this doesn't go to the admissibility of the simulations, it most certainly goes to the weight that should be ascribed to them.

MR. DeRENSIS: I want to make a few points. One of them is that Mr. DeVilliers' simulations are designed to determine whether or not the Perma device is a viable device, as he said it was, whether it had the potential of being an anti-skid device, and the simulation was an analytical tool to accomplish that result. It is just as good a method of doing it as any other method. It is just as good as road tests because road tests measure different things and have a lot more variables and a lot more risks of things going wrong.

MR. BENBOW: You said it.

MR. DeRENSIS: There are a lot of things in an automobile that could be measured that could have an effect. We have seen where there have been glazed brakes, for example

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worn tires affect results. The point relating to these documents is that at some point they offered us two units and only two units. They have never identified what units they were, when they were manufactured. We had a lot of difficulty finding that out. I don't believe we ever determined that. And as Mr. Grand said, to do the kind of tests that Mr. Lagemann is proposing is really part of a development program rather than an analysis of the viability of this product.

MR. LAGEMANN: I could address that, too, your Honor.

THE COURT: Wait a second. You say that you sent them two units. You said that you got two units on condition that they not be used in any manner to risk bodily harm or injury to any person. Is that it?

MR. DeRENSIS: Yes. There was another letter with those I was required to sign, saying that I would take those only under the condition that they not be used in a way to cause bodily injury.

THE COURT: What do you need these in for?

MR. LAGEMANN: Are they accepted or not?

THE COURT: No.

BY MR. LAGEMANN:

Q Drawing our attention back to the governor itself, Mr. DeVilliers, is the action of the governor which you

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simulated entirely mechanical?

A As opposed to what, electrical, electronic?

Q Yes.

A The governor by itself -- and by governor I mean just the flying weights portion, that is, mechanical, the solenoid obviously is electrical-mechanical.

Q When the solenoid is retracted and the governor is working on its own, is it operating as mechanical device?

A Well, I guess also there is the cam gear and the microswitch. When the solenoid is retracted and the circuit in the back of the solenoid can is connected so that the microswitch is not involved, yes, it is a mechanical device.

Q Would there have to be friction between these mechanical parts when they are in motion?

THE COURT: Between what mechanical --

MR. LAGEMANN: The mechanical parts in the governor, your Honor.

THE COURT: Friction between mechanical parts in the governor? He is talking about the governor as being the flying weights. The flying weights are attached to the -- I don't know where you are going.

Q By the governor, I believe you mentioned some components before that are comprised within the governor. Let me see if I understood you correctly. Did you mention

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the flying weights?

A Yes.

Q Was there a governor shaft?

A Sure.

Q Was there a spring?

A Yes.

Q Was there a cam gear?

A Sure.

THE COURT: Is that part of the governor? Do you consider the cam gear as part of the governor?

THE WITNESS: Yes. Not really. It is only since it drives it. To me the governor is the expanding and contractive flying weight system.

THE COURT: For purposes of this question, consider it as part of the governor, all right?

THE WITNESS: Okay.

Q Are there places or locations in the governor as we have just defined it where mechanical parts interact, touch one another while they are in operation?

A Sure.

Q Are those components going to generate friction?

THE COURT: The answer is yes.

A Of course.

Q And did you simulate that friction?

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A No. I assumed it to be sufficiently negligible not to have to cope with it.

Q Could that friction cause hysteresis of the governor in operation?

A Only if it was high enough that the governor could actually stick, which I have not seen anything like that in the units such as the one in front of me.

THE COURT: All right, for the benefit of the Court of Appeals would you spell hysteresis and then explain exactly what it is?

THE WITNESS: Okay. Hysteresis, h-y-s-t-e-r-i-s --

THE COURT: All right, tell us what it is.

THE WITNESS: Hysteresis is a phenomenon which --

THE COURT: Let me try, and see how far I get without making a mistake, all right?

THE WITNESS: Sure.

THE COURT: Where you have moving parts you have friction. Friction causes heat, is that correct?

THE WITNESS: Yes.

THE COURT: All right. It is the end result, when the heat becomes so great that the parts have a tendency to stick called hysteresis?

THE WITNESS: That might be a form of it. I was going to say it is a sticking phenomenon. If, for instance,

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to get back to my example of pulling things along, if I pull this along, I have to exert a force to move it. Now I stopped, and yet I am still exerting just barely the amount of force -- just slightly below the amount of force to move it. Now, to move it in the opposite direction, I have to retract that force and pull the same amount of force on the opposite direction to start moving it.

So in the sense that -- that is really, I think, a hysteretic phenomenon. It is more commonly encountered in the field of magnitism.

I will think of another example. I think in terms of the meaning of that question, by hysteresis it means sticking, pure and simple. You push something over here, it sticks; you have to pull on it to get it started back the other way. That is hysteresis.

THE COURT: Okay.

MR. BENBOW: While Mr. Lagemann is consulting, your Honor, just to return for a moment to D-658 and 659, you are clear as to why that limitation was put in the transmission of these devices, I assume?

THE COURT: Yes, I have read letters from lawyers before. I am quite clear as to what it is.

MR. BENBOW: Concern for product liability.

THE COURT: I am quite aware of it.

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Q Mr. DeVilliers, does friction resist motion?

A Static friction -- yes, friction resists motion. Yes, that is a true fact.

Q When the term hysteresis is used in mechanical engineering, is it used to connote the fact that something with cyclical behavior will --

THE COURT: Tell you what, it's almost end of the day, and I recognize you are trying to do your best, but why don't you and your expert get together over the evening and write out exactly what this next one is going to be. I'm sure it's going to be a pip.

MR. GRAND: Mr. Lagemann has indicated he is, in no event, going to finish tomorrow. I hesitate to ask Mr. DeVilliers to give up a full day of work to be here for half day, so I would suggest that we go over to Monday and that might have the benefit of letting Mr. DeRensis get well as well.

THE COURT: That's great. In the morning one side asks for tomorrow off, and in the afternoon the other side.

Sure, take tomorrow off. I have got lots of other things to do.

Between now and Monday, figure out what you want to do with D-656.

MR. GRAND: I will.

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MR. BENBOW: Do you know if we are not sitting tomorrow what the program looks like for next week? Will we be sitting each day next week, if you now know, your Honor?

THE COURT: God willing.

MR. BENBOW: Thank you, sir.

THE COURT: Okay. Have a good weekend.

(Adjourned to Monday, April 29, 1974 at 10 A.M.)

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WITNESS INDEX

Name	Direct	Cross	Redirect	Recross
Andre Leonard DeVilliers (Resumed)		3712		

EXHIBIT INDEX

Defendant	Identification	In Evidence
657		3803
658		3825
659		3825

Perma Research & Development Company
v.
The Singer Company 66 Civ 665

New York, May 1, 1974
10:15 a.m.

- - -

(Trial resumed.)

- - -

A N D R E L E O N A R D D E V I L L I E R S,
resumed.

THE COURT: Mr. De Villiers, you recall that you were placed under oath. I recognize that due to personal problems you may have been put out in connection with your work, and my apologies for that.

THE WITNESS: No problem, sir.

CROSS EXAMINATION

BY MR. LAGEMANN CONTINUED:

Q Mr. De Villiers, I am handing you a number of exhibits. These are Exhibits 123, 124, 125, 127 and 128, 129 and 132, 133, 133-A, 134 and 135. We will be referring to these exhibits from time to time. Let the record reflect that they are before you.

Mr. De Villiers, did you read the Perrino patents in preparation for your simulations?

MR. DE RENSIS: Before you answer that, I think

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on those identification of exhibits we don't have them identified as plaintiff's exhibits or defendant's exhibits. The record should reflect that they are plaintiff's exhibits.

MR. LAGEMANN: That is absolutely correct.

THE COURT: Okay.

Q I will repeat the question, sir.

Did you read the patents of the Perma device in preparation for your simulations?

A In preparation for my simulation I reviewed, read -- whatever you want to call it -- reviewed, I think that's a better word, one or more patents of the system. I am talking about very early.

Q I am sorry, I can't even hear you from here.

A Very early in my involvement.

You asked me did I read them in preparation to do the simulation.

Q That's correct.

A And I am saying that prior to commencing the simulation I reviewed one or more. I believe I did that in Mr. Perrino's office. I think it was just one.

Q Mr. De Villiers, I hand you Plaintiff's Exhibit 13, which is one of the patents of the Perma anti-skid device, and ask if that was one of the patents which

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you read before you commenced running your simulations?

MR. DE RENSIS: Your Honor, I want to object to that because I think there are five separate patents, and I think he should be shown all of them rather than select one.

THE COURT: Let's start off with one, see if he read that one, then go on to 2, 3 and 4.

A The patent, particularly the patent drawings that I looked at prior to commencing my simulation had basically what I see in front of me here on them.

Q Would you turn to the descriptive portion of that patent and tell us if you read the description of the inventor of how the device operates, which is contained in that patent, prior to running your simulation?

A I don't really remember that, whether I did or not. I read some of it and I talked to Mr. Perrino at the same time, and I don't remember just what I read, when, in that respect.

Q Specifically, sir, with reference to the relationship between the cam gear and the governor shaft, did you simulate the device --

MR. LAGEMANN: Withdrawn.

Q Did you simulate those components to operate in the way the patent says they will operate?

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MR. DE RENSIS: I object to that, your Honor, because we don't know which patent he is looking at and there are four other patents, and he hasn't said he remembers this particular patent.

MR. LAGEMANN: 13.

THE COURT: I understand. He is looking at 13.

MR. DE RENSIS: Nor do we know which specific portion of it his attention is being drawn to.

THE COURT: Well, can we draw it to a particular portion?

Q All right, will you look at columns 9 and 10?

A This helps me.

Q I think I can help you with the line, sir.

A Please.

Q Specifically, did you read lines 16 through 23 in column 9 of Plaintiff's Exhibit 13?

MR. DE RENSIS: At any time?

Q Prior to the simulation.

A I don't recall whether I read those lines at the time or not, but as I read them now, that is the way I understood the thing to work basically.

Q Is that the way you simulated it to work?

A If I read this correctly. Let me read this again to make sure.

Yes, my simulation affects that activity.

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Q Which activity is that? Are you referring to the arming or to the --

A The whole -- everything that is said there.

Q What does it say there? Does it refer to arming there, sir, or does it refer to operation of the governor?

MR. DE RENSIS: It speaks for itself. It's in evidence.

THE COURT: Let me read it.

All right. Go ahead, next question.

Q Did you, sir, simulate the pin going trom stop to stop in the cam gear during arming of the Perma device?

MR. DE RENSIS: Your Honor, I think that has been asked and answered.

THE COURT: All right. So let's have it done again. Go ahead.

A Let's see. I simulated the effect of it.

Q The question is, sir, did you simulate the pin actually traveling the length of the slot in the cam gear?

THE COURT: I think he has answered it now. He said he simulated the effect of it.

Q Show us, sir, if you could, the formula which simulates the effect of it, "it", referring to the pin traversing the slot in the cam gear.

THE COURT: Is that part of the formula or is that

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a constant?

MR. LAGEMANN: It may be both, your Honor.

A The formula governing the motion while in that slot is one called deceleration sensor on Exhibit No. 134.

MR. LAGEMANN: Let the record reflect that the witness is referring to Page 4 of Plaintiff's Exhibit 134.

A The actual stops involved there would simply be reflected in that -- let me think.

The activity of the stops there would be reflected in the fact that there would be certain limiting decelerations that would be represented at that point at the time it hit the stop, just so that the simulation realizes that the thing doesn't keep on going around the cam gear when it's at a stop.

Q Sir, does that formula to which you are referring, which is labelled deceleration sensor on Page 4 of Plaintiff's Exhibit 134, does that formula contain the 20 millisecond constant?

A Yes. I assume you are referring to the tau sub DEC. Yes, that is -- in the simulation that equation is integrated there, under the effect of that time constant.

Q Does that time constant represent the period of time it would take the pin to travel 63% of the distance of the slot in the cam gear?

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A Assuming that you put in enough input deceleration to the cam gear to cause it to go all the way to the end of the cam gear travel. Then based on, as I mentioned, first order representation of the cam gear that would be correct.

Q I wonder if you could keep your voice up, Mr. DeVilliers.

A I am sorry.

Q Let me see if I have this correctly. You are saying if we assume that there was enough deceleration to move the pin all the way up to the upper stop on the cam --

A And that the pin was at the bottom of it in the first place where you are starting from.

Q Correct. [continuing] -- that the 20 millisecond time constant would represent the time that it would take that pin to traverse 63% of the slot; is that correct?

A Yes, based on, again, the first order representation of the system which is -- well, based on that.

Q Very well, sir. Let's assume that what we were talking about had happened. We have the deceleration, it is sufficient to cause the pin to move all the way up to the top, and we are computing it on your formula in Plaintiff's Exhibit 134.

A Yes.

Q After 20 milliseconds, the pin would have traversed

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63% of the distance of the slot; is that correct?

A Yes.

Q What happens in the next 20 milliseconds, sir?

A Assuming that the wheel is continuing to decelerate--

Q That's correct.

A [continuing] -- and that there is enough deceleration still on it to hold it at the top of the slot, it will simply stay there until the deceleration falls below that magnitude required to hold it there.

Q But, sir, you have just said we are only 63% of the way up the slot.

A I thought you said when you got all the way to the top. I am sorry.

You mean beyond that, after the 63%? It will keep on climbing.

Q Can it ever reach the top of the slot?

A With a first order representation it would approach the top of the slot asymptotically.

THE COURT: Tell us what asymptotically means.

THE WITNESS: If one imagines in space or on a piece of paper that you draw a "Y" and a "X" axis, the "Y" axis going vertically, then if you go up the "Y" axis a little ways and you draw a horizontal line, then you start a response such as we are talking about down at the origin where the

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"X" and the "Y" cross and have it rising and going off to the right, a positive "X" and "Y" axis, the asymptotic approach -- that line that I suggested we draw is an asymptote and our response will come up and approach that and get closer and closer to it as it goes on out in space or in time.

So that is a characteristic of a first order representation. The distance between our response and that fixed value represented by the horizontal line decreases to, you know, nothing, out in infinity.

Q Mr. DeVilliers, if we are using this sort of equation can we ever simulate the pin actually reaching the end of the slot in the cam gear?

A Yes.

Q Mr. DeVilliers, after 20 milliseconds we have traversed 63% of the slot; is that correct?

A Based on all the assumptions that I testified to earlier.

Q That's correct. But will we be at 63% after 20 milliseconds?

A Based on those assumptions.

MR. GRAND: Can I have that question read back?

THE COURT: Based on the assumptions will we be 63% up the slot at 20 milliseconds.

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Q How far will the pin be up the slot in percentage terms after 40 milliseconds or two of your 20 millisecond time constants?

A It would simply be farther up the slot. I can't from memory state just exactly how much farther up the slot it would be, but it would be farther up the slot.

Q Let's see if we can figure out how much farther up the slot it will be.

MR. DE RENSIS: Your Honor, I object here on the grounds of relevance because clearly what is relevant is when the microswitch closes. What we are doing is exploring an area of such marginal relevance, and Mr. DeVilliers already testified that it in effect approaches asymptotically and therefore it has gotten there.

MR. LAGEMANN: Your Honor, if I may interject, if we are going to discuss the relevance of this, may I suggest we do it at side bar.

THE COURT: Sure.

[At the bench.]

MR. DE RENSIS: Your Honor, my point is that there is a lot of detail of simulation which is really not relevant to this case.

THE COURT: It's Mr. Lagemann's position -- correct me if I am wrong -- that the failure to include certain items

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in the simulation is such as to destroy the validity or at least affect the validity of the simulation.

MR. LAGEMANN: That is correct,your Honor.

THE COURT: My problem is this: It could be done a lot faster, I think, by just going to things which are not included in the simulation. Just list them off. Did you include this? No. Did you include this? No. Did you include that?

It's very obvious that he did not include all things in the simulation.

MR. LAGEMANN: Very well, your Honor.

THE COURT: But getting into this area of pure physics and delightful math is something which makes life even more difficult than it has been for me.

MR. LAGEMANN: Very well, your Honor. I will be going, however, into one other of this type area which I believe to be highly critical within the patent, if your Honor will permit.

THE COURT: Yes.

MR. LAGEMANN: Very well.

THE COURT: All right. Go ahead.

[In open court.]

BY MR. LAGEMANN:

Q Mr. DeVilliers, after the plunger in the solenoid

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has been retracted, is the system armed?

MR. DE RENSIS: Your Honor, I object because I think we have to get a definition of what retracted is, or at least there is an assumption in that question which is not stated.

MR. LAGEMANN: I think I can take care of that, Your Honor.

THE COURT: All right. Go ahead.

Q Mr. DeVilliers, after the plunger in the solenoid has been fully retracted, is the governor free to expand and collapse and therefore control the brakes?

A Yes.

Q Does that mean that the system has been armed, so to speak?

A Yes, I would consider the system armed.

Q Very well.

A The word "armed" is a rather subjective term in the whole thing. But I have heard it used in skid control and other control-type of work, so all right, I will agree to that term.

MR. BENBOW: Could you agree to it more loudly?

THE WITNESS: Yes, sir. I am sorry.

Q Mr. DeVilliers, I am showing you Plaintiff's Exhibit 13 again and am directing your attention to Line 19 in

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Column 10 thereof. I would ask that you read from that point to the end of Line 24. Then I will ask you some questions about that statement.

MR. LAGEMANN: Would your Honor like a copy of this patent?

THE COURT: What were the lines?

MR. LAGEMANN: Starting at 19 in Column 10, your Honor, reading down to the end of let's say, Line 24.

A Okay, I have read it.

Q Do you see, sir. on Line 22 and Line 23 where it says, "The governor assembly takes over control and, as it is stopped by stop surface 225 of the cam gear, spring 218 will cause the governor assembly to commence to collapse?"

Is that the way you simulated the operation of the governor once the system had been armed?

Look at Figure 5, if you will, the drawing of the cam gear.

MR. DE RENSIS: Your Honor, perhaps we can give him a piece of hardware that might assist him.

MR. LAGEMANN: He has the drawings in Figure 5A of that same patent, Plaintiff's Exhibit 13.

MR. DE RENSIS: Again, those are schematics, I believe.

A Okay, I have Figure 5A. I will have to go back and

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read this again. I am a little bit confused by some of that.

MR. DE RENSIS: Your Honor, I would like to hand him Plaintiffs' Exhibit 3 and 4.

A Well, for starters, I will say I simulated a Perma-Vac -- a governor that operates like this does in front of me basically.

THE COURT: What exhibit is that?

MR. GRAND: 3 and 4, your Honor.

MR. LAGEMANN: He is looking at 3, your Honor.

A I mean in terms of all these stop surfaces. I want to read this again though.

Q Please do, sir.

A I always have a hard time with patents.

MR. BENBOW: When you resume, would you keep your voice up, Mr. DeVilliers.

A Yes, now that I read that about three times, that's what I simulated.

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3/1 am

Q Did you simulate, sir, the pin travelling all the way to the upper stop of the cam gear when the governor was in control of the system?

A Only if it was called for to go all the way to the top. It doesn't have to go all the way to the top.

Q Would it go all the way to the top with a wheel deceleration of, let's say, 3G, sir?

A Yes, it would. I would expect it to. I would expect it to. I don't know precisely what number it takes. I put a number into the simulation of 2Gs.

Q Did you use the same time constant to represent when it would travel all the way to the top?

MR. DE RENSIS: I object to that. What is the same time constant?

THE COURT: I think we are referring to the 20 milliseconds to take it 63 per cent of the way up the slot; is that the one?

MR. LAGEMANN: Yes.

THE COURT: Okay.

A Yes, the same time constant --

THE COURT: Was used in all these simulations, right?

THE WITNESS: Yes.

THE COURT: All right.

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Q How many milliseconds, sir, would it take on a 3G wheel deceleration for the pin to reach the upper stop surface of the cam gear when the governor is in operation?

A For a 3G stop?

Q Yes.

THE COURT: If you know off the top of your head.

A Roughly, it would take about the magnitude of the time constant because what it would be going to do, for a 3G stop, if you put in a 3G deceleration starting from the pin at the bottom of the cam gear, then it would take 63 -- it would take, within the time of the time constant, the 20 milliseconds, it would go two-thirds or 63 per cent, almost two-thirds of 3Gs, which would represent going essentially to the top of the slot.

Again, a first order representation being assumed.

Q In real life, sir, do you know how long it would take that pin to travel the length of the cam gear slot upon receiving a 3G wheel deceleration?

MR. DE RENSIS: I object to that.

THE COURT: He has already testified he did no experiments directly on the thing. How could he know? He is in the realm of theory.

Q Mr. De Villiers, was there a constant or a limit of some sort in the program which would limit the motion

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of the pin once it reached the stop, when the governor is in operation?

A Yes.

Q Was that the 138-1/2 degree figure you calculated the other day?

A No. The limit was represented by a value of -- the limit, the pin reaching the limit was represented by a limiting value of sensed decleration in the cam gear system.

MR. DE RENSIS: Speak up. I didn't hear the end of that.

THE WITNESS: By a limiting value of sensed decleration.

Q Mr. De Villiers, could you please point out that limiting value in any of the exhibits you have before you? I would imagine it would be in 132, 133, 133-A, 134 or 135.

A I don't believe that appears on there.

Q It does not appear, sir?

A I don't believe so.

Q Then where is it?

A Now?

Q Now.

A It is a number that was used --

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MR. DE RENSIS: Objected. What is the relevance of any of this?

THE COURT: I don'tknow, but let's find out.

A It represented a --

THE COURT: Go ahead, go ahead.

Q Sir, the question is where is it, not what it represented.

A It's not here.

Q Where is it then?

A It was a number that was in the program when it was running. It's a fixed thing. You can change it. It's arbitrary.

Q It is in the program but it is not in any of the exhibits before you?

A No, I did not -- you know, it's a detail and it's not there.

THE COURT: It's only an arbitrary number, is that what you would say?

THE WITNESS: Yes. If I remember correctly, I tried to make some estimate as to what it might be, you know, from studying the cam gear, much in the same way that I calculated the .92Gs and it appeared that it would be something over that. I decided, you know, 2.0Gs was adequate. To my mind it really didn't make that

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much difference what I put up there.

Q 2.0Gs is adequate for what, sir?

A Fo a deceleration that would represent the thing being at the top of the cam gear slot. It's all in the design of the cam gear angles, the angle of the cam gear, the spring rate of the micro switch, friction coefficient on the cam gear, everything.

Q Mr.De Villiers, are mu slip curves an integral part of any simulation of an automobile during brake?

A Yes, the mu slip curves, they produce, in a simulation -- they are used to generate the -- for the given wheel speed and car velocity they represent, you know, they produce the co-efficient of friction at a given wheel, so, yes, they are a part of it.

Q In other words, let's put it this way, sir: Can you run a simulation of an automobile during braking without a mu slip curve?

A No. Well, wait a minute, let me correct that slightly. I can think of a way that you could do it in terms of -- but it wouldn't be very meaningful to skid control.

Q If you put different mu slip curve values into your simulation would you get different stopping distance results?

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MR. DE RENSIS: I object to that because I don't know what "different" means. I think he testified that he used different mu numbers, and he also used a sliding mu friction, so I don't know --

MR. LAGEMANN: I don't think he testified to that.

MR. DE RENSIS: I believe that was his testimony.

MR. LAGEMANN: Show me the page on the sliding thing, sir, and I will --

MR. DE RENSIS: In any event, the objection is there is no definition here what we are talking about, different mus, different from what? So I object to the question.

THE COURT: I don't think that is the question. I think the question is were different curves used rather than different mus. Can you answer that?

THE WITNESS: Yes.

MR. LAGEMANN: Maybe I can --

THE WINTESS: Yes, there are different curves used to represent the different roads.

THE COURT: All right. Now, supposing you are trying to represent the same road. Is there one set curve that you would use?

THE WITNESS: For the same road, same road condition,

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I would say --

THE COURT: Yes, same road condition.

THE WITNESS: Concrete road, dry, yes, asphalt, et cetera, for a given road it is a certain mu slip curve.

THE COURT: Okay.

MR. LAGEMANN: Sorry, I could not hear that.

THE COURT: For a given road it is a given mus slip curve.

THE WITNESS: Yes. I testified to that. I think I used the name friction model. That is a mu slip curve.

Q Let me see if I understand you, sir. Are you saying for a given road surface, a given vehicle and tire combination, there is a single mu slip curve? Let's take dry concrete.

A For a given tire-road surface combination, we simulated a mu slip, velocity surface. I think I understand what you are getting at. That is why I am phrasing it this way. So thatin that sense of the word, yes, we represent a single mu slip, velocity surface. A surface is a three-dimensional curve, if you want to put it that way, or a spatial representation, talking about surface.

Q Does the shape and configuration of that curve on the same surface and the same road-tire combination

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change with speed?

A Yes, it is allowed to.

Q Does it in real life, sir, not what you did? We are not there yet.

MR.DE RENSIS: I object to the characterization of one world is real world and the other world is something else.

THE COURT: Go ahead and answer it anyway.

A The experimental research literature that I have read, some of which is here in evidence, makes that fairly clear, that on various roads this is allowable, this happens, and it happens more on some roads than on others, and in particular I believe, as I testified to, it is quite a phenomena on a wet road.

On a dry, concrete road, my recollection is it is fairly minimal, the variation with car velocity, but there is some variation there.

Q Mr. De Villiers, if you were to run a simulation using one set of curves, lt's say for a .75 mu surface, and I were to run another simulation and I used a different set of mu slip curves, could we get different results?

MR. DE RENSIS: Your Honor, I object, because we are referring to a different set of mu slip curves from one stop --

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MR. LAGEMANN: I am referring to two different simulations.

THE COURT: He is running one simulation; Mr. Lagemann is running a different simulation. They decide to put in different mu slip curves. The question is do you get a different answer, and the answer is obviously yes.

THE WITNESS: I would expect a different answer unless coincidental occurs.

Q You mentioned, sir, the variation of mu slip curves for a given surface with different speeds. Would that apply in, let's say, a single 60 mile an hour stop; would the shape of the curve change as the vehicle slowed down?

A Yes.

MR. DE RENSIS: I object to that because of what I think is a little bit of a misleading use of the word "change" of shape. What we are talking about, I think, is a change of slope, not a change of shape.

THE COURT: I understand.

Q Mr. De Villiers, would you look at the exhibits you have before you, in particular Plaintiff's Exhibits 132 through 135, and show us a formula which tells us what the slip was during your simulations, with the shape, if you will, of the mu slip curve?

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MR. DE RENSIS: Your Honor, I object because during direct testimony he testified he did not have that in there; rather, he described it orally in the testimony as to what that curve looked like and how he derived it.

THE COURT: All right, let's go through it again, then.

A On No. 132 we make reference to the functional relationship of mu with slip, bottom of the page. Other than that, the specific -- well, that's what's here.

Q What is the function of slip that represents mu in thatformula?

A I don't have the mu slip formula down on the paper. I just simply note that it is there.

Q Is that contained in your program, sir?

A Yes, it was used. I might add it is a fairly straightforward thing that is in consonance with other papers. It produces a curve that looks like the literature I think you are holding in your hand.

Q All right. I am handing you, sir, a copy of Plaintiff's Exhibit 136 and directing your attention to --

MR. LAGEMANN: Excuse me, your Honor, I had better get the original.

Q Would you please look, sir, at page 577 in

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Plaintiff's Exhibit 136, and look at the charts or graphs thereupon. Are those the mu slip curves that you said were represented in your simulation?

A Yes, I used these for reference.

Q Did you enter those precise curves in, sir, or did you enter in some other curves?

A It is not possible to enter these precise curves. They don't give you equations in there for them. I entered curves which produced shapes of about this sort.

Q But you didn't get these precise curves, did you?

A I made reference in earlier testimony to things like peak values of, you know, the mu peak at the roughly 15 to 20 per cent slip which you can see rather clearly is shown on these curves, and the value of mu at slide, which again is shown on these curves, and the rough speed relationships that are implied on these curves, and I caused a simulation to produce curves of this shape with those key parameters in them.

Q Did you derive your formulas from these curves in Plaintiff's Exhibit 136 or was there another source?

A No, I didn't derive the formula -- well, I guess I should be careful there, that I am answering your question. I used simple formulas to produce curves of really very close to this shape, again based on the key parameters that I just

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mentioned.

Q Did you have a body of underlying slip data available to you when you wrote these formulas?

A I just said the formulas produced roughly what is here. That, to me, is adequate reference. It is a published piece of experiemental work done at General Motors Proving Grounds, a place I happen to respect.

Q Do you happen to recall offhand what those formulas and constants representing the mu slip curves in your simulations were?

A Do you mean the numerical values of them?

Q The values and the formulas or equations, sir.

A The equations for the --

MR. DE RENSIS: Your Honor, to save time here, we would be happy to prepare a sheet of paper with the formulass on it and turn it over to counsel for the defendant over a lunch time break.

THE COURT: Can you do it over lunch?

THE WITNESS: I believe we can, yes.

THE COURT: It makes life easier.

MR. LAGEMANN: Would you also give us the constants, sir, over the lunch break?

MR. DE RENSIS: If there are any.

THE COURT: Well, it's equations. If there are

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constants in it, I assume that they will be shown up, right?

THE WITNESS: Yes, the ones that I have available here with me, I think we can at least get some of them of you.

Q In fact, aren't there constants for every different speed on a given surface?

A Those are computed within the -- well, you're talking about a variable constant. What I think you are referring to is computed in the program, based on the basic data that goes into the friction model.

Q Wouldn't there be a set of constants, sir, for each assumed road condition?

MR. DE RENSIS: It has been asked and answered.

MR. LAGEMANN: I don't think so.

MR. DE RENSIS: He said it was a variable that was computed.

THE COURT: He said it was a variable constant. That is what he was trying to tell you before.

A It's kind of a contradiction when I said it that way.

Q Mr. De Villiers, would you take a look at Plaintiff's Exhibit 127 and get that before you at this time.

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A Yes, I have it in front of me.

Q Was that the first simulation run performed? Well, let me rephase that.

Was that the first of the printouts that we have before us that was performed?

A The first?

MR. DE RENSIS: Your Honor, I object to that because we have got exhibits here with maybe 30 or 40 runs.

They were put in order by me in terms of their speed, from high speed to low speed. They are no longer in any semblance of --

THE COURT: Let's find out if this is the one he first ran. It doesn't matter.

A I don't think this would have been the first one.

Q Which one was?

A I don't remember.

Q Did you run them all in one day or did you run them over a period of time?

A Well, obviously they were run over a period of time. Just how much time, I don't exactly remember.

Q How many days?

THE COURT: He says he doesn't remember.

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MR. LAGEMANN: All right, I will withdraw it.

A This is not the first one, I am quite sure of that.

Q The question, sir, is is it the first one of the ones you see before you?

A Is this the first? No, I don't think this was the first of the runs that I produced.

Q Do you recall what month you ran these printouts?

MR. DE RENSIS: I object to this. What is the conceivable relevance of any of this?

THE COURT: Besides that, we have gone over it before. Objection sustained.

MR. LAGEMANN: With very different results, your Honor.

Q Where did you first run your computer simulation, sir?

MR. DE RENSIS: Your Honor, this was asked before.

MR. LAGEMANN: No.

THE COURT: Sure was. If he comes out with the same answer, I am going to worry about you, Mr. Lagemann; you haven't either been listening or reading the record. Go ahead, give us an answer.

A Where did I first --

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THE COURT: No, no, when, what month?

MR. LAGEMANN: No, I believe I asked, your Honor, where.

Let me withdraw it.

MR. DE RENSIS: He said he ran it at the computer center.

THE COURT: Go ahead. Where?

A Where did I run -- assuming you mean to produce what was brought here? This is run at AVCO.

Q Did you make any runs before AVCO?

A I made -- I guess there were some drafts, test runs, to see how it was running. I got a little bit of available time on the computer where I worked to do that.

Q Was that at Sweetheart Plastics, sir?

A Yes.

THE COURT: This was all gone over before. I knew every answer before he came out with it, and I don't have ESP.

Q What were the results, sir, of the first run at Sweetheart Plastics?

MR. DE RENSIS: Your Honor, I object to that. There is no relevance here.

THE COURT: I have no idea where it is going.

MR. DE RENSIS: There is no testimony what he ran

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or whether he did run runs.

THE COURT: He said he was doing testing, drafting.

Q What did you test? Was it the entire simulation, the vehicle model, the road data and the Perma device, all in conjunction at Sweetheart?

MR. DE RENSIS: Objection.

THE COURT: Let's hear it again.

A During this drafting of the device, it would have run with the model of the vehicle, yes. Sometimes it didn't run.

THE COURT: In other words, you were testing out your program.

THE WITNESS: To make sure it's a realistic program and that it works, you know; computers stop rather quickly when they don't like what you give them.

Q Did the computer in any of your debugging runs at Sweetheart Plastics ever not shut itself off?

MR. DE RENSIS: Your Honor --

THE COURT: Not shut itself off?

MR. LAGEMANN: Yes. Did it ever complete a run?

MR. DE RENSIS: Your Honor, I object, first of all, to the characterization of debugging because that is not something the witness used, and secondly, I don't

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see any relevance whatever to what was done at the Sweetheart Plstics versus what was done at AVCO. I think we are making a distinction without any point whatsoever.

THE COURT: I know what you are driving at, Mr. Lagemann. Let me see if I can get there easier.

Did you change the program in any sense between the time you started working or drafting it at Sweetheart and the time you finished doing these particular runs at the AVCO?

THE WITNESS: Oh, yes, I think if I understand the question, yes, the program was developed.

THE COURT: Yes, okay.

THE WITNESS: Until we thought we were producing a reasonable model of the Perma system.

Q Did you change any of the constants?

MR. DE RENSIS: That has been asked.

THE COURT: That's part of the whole --

MR. LAGEMANN: The program, your Honor, I believe, is quite different from the constants.

THE COURT: Did you change any of the constants also?

THE WITNESS: Many of the constants, you know, were input data to the program.

Q Did you change any of the input data?

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A Well, to produce a stop on an icy road you have to use different input data than to produce a stop on a concrete road.

Q Did you produce any data at Sweetheart which was different from the data you used at AVCO?

MR. DE RENSIS: I object to this on the grounds of relevancy. Whatever point there is has been made.

We are just going over the same ground.

THE COURT: I think we are.

A I did develop --

THE COURT: You developed a program between one place and the other, is that right?

THE WITNESS: A lot of the development was done at AVCO. I only went to AVCO when it was clear the little bit of time that was available that I could use was not going to be enough, so I went to a public computer center. It doesn't matter if you go out and run it on an IBM computer or a Univac computer, whatever, it runs --

THE COURT: Okay, we understand.

Q Did you change any of the time constants?

A I might have. Probably did, during the development.

Q Was that because the initial runs were producing

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unfavorable data?

MR. DE RENSIS: Your Honor, I object to that.

THE COURT: I will permit it.

A I don't think it is so much of a question -- the question has to be asked, what is unfavorable? The important thing is to make sure that when one simulates something that one is, first and foremost, making a reasonable representation of what he is trying to simulate. Now, if in the process you get data which looks ridiculous, unfavorable, whatever you want to call it, you start to ask questions, and if in asking your questions you come back and you make a good conclusion that, you know, you have got an error or, you know, how you are simulating something in the first place, then you fix it. I mean, isn't that reasonable?

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BY MR. LAGEMANN:

Q Mr. DeVilliers, did a 1968 Thunderbird employ a split braking system?

A I believe it did.

Q Was that split braking system a part of your simulation?

A No. I mean, not explicitly. The simulation didn't care.

Q In a split braking system, sir, are there two plungers in the master cylinder, one for the front brakes and one for the rear?

THE COURT: Haven't you asked that question?

MR. LAGEMANN: I don't believe so.

A You are speaking in generalities. It depends on what car you have.

Q On a '68 T-Bird, Thunderbird.

A The best I can answer you is that in my 1967 Mustang it was that way. I presume Ford did it with the rest of their stuff, too.

Q Did your simulation take into account that the volumetric requirements for locking the front wheels in a 1968 Thunderbird were different than the volumetric requirements to lock the rear wheels in that split braking system?

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A My simulation produced torque at the wheels.

Q Did it take it into account, sir, by using torque, or did it assume brake pressure available to generate the torque?

A Yes.

MR. DE RENSIS: Can we have one question?

THE COURT: What?

MR. DE RENSIS: We have two questions here. I want to know which one we are getting an answer to.

THE COURT: All right. Mr. DeVilliers, was your "yes" to the part that you used torque in your simulation?

THE WITNESS: My last "yes" was that I assumed brake pressure available to produce torque.

THE COURT: All right.

Q Did the 1968 Thunderbird have a proportioning valve?

A To my best understanding, yes.

Q Did you include a proportioning valve in your simulation?

A Yes.

Q Did that proportioning valve alter the ratio between the effect of the front and rear brakes at different master cylinder pressures?

MR. DE RENSIS: Your Honor, I object to the word "alter." I think the testimony on direct was that --

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MR. LAGEMANN: Your Honor, I must object to testimony by counsel.

THE COURT: He has a right to object.

MR. LAGEMANN: In one word, I would think, your Honor.

THE COURT: I will tell you what. If I could have that from both sides in this case it would be a great joy.

I will permit the question.

Q Do you recall the question, sir?

A Yes. It was about whether we had a proportioning valve, et cetera, and my recollection was we went to the back of the room and off the record discussed it.

Q Did the proportioning valve vary the ratio in braking effect between the front and rear wheels at different master cylinder pressures?

MR. DE RENSIS: Object to the word, "vary."

THE COURT: I will permit it.

A If I understand you correctly, I simulated what a proportioning valve does. Let's put it that way.

Q What does a proportioning valve do?

A Okay. A proportioning valve is a little device that below a certain pressure input to it, the same pressure -- the same increment of pressure comes out the other side of it, but above what is referred to as the split point and

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increment of pressure into it produces a different, a lesser increment of pressure out of it, and the utilization of it in cars is so that when up in a high deceleration stop in which there is a lot of weight transfer that the pressure buildup to the rear brakes now is not at the same rate any more as it was to the front brakes. They do this with a two-slope device.

Q In other words, if we were to plot out the relationship between braking effect there would be a straight line up to the brake point and then the line would change; is that correct?

A Yes, at the split point.

Q At the split point?

A Yes.

Q Does that change the amount of pressure available at the front and rear wheel?

A It changes the -- it's an incremental thing, right. If we start out on the assumption that below the split point that the front and rear wheels were receiving the same brake pressure, 10 psi added onto the front brakes also was 10 psi added onto the rear brakes, this would hold up to the split point. But after the split point 10 psi at the front brakes would only add on maybe 8 psi to the rear brakes.

Q Did any 1965 automobile have a proportioning valve,

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if you know?

A I don't honestly know exactly when they started putting them on American cars.

Q Did the 1968 Thunderbird have disc brakes, sir?

A It had them on the front. I am not sure whether it was an option or whether they were standard, but they had them on the front.

Q Do you know whether disc brakes were available as an option in 1965, and if so, how widely available they were?

MR. DE RENSIS: Let's have one question at a time.

THE COURT: If he knows. Do you know?

A I think there were some available, but I probably should be saying I don't know.

THE COURT: All right. You are better off, if you don't know, saying so.

Q Mr. DeVilliers, do you still have before you the same exhibits we started out with this morning, being 123, 124, 125, basically up through 135?

A Yes, I am sure they are all here.

MR. DE RENSIS: He does not have 3 and 4.

MR. LAGEMANN: I am not concerned with those.

Q Do any of these exhibits contain a written exposition of the logical processees employed to produce the

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printouts in Exhibits 127, 128 and 129, Plaintiffs' Exhibits?

MR. DE RENSIS: Your Honor, I object to that because the documents speak for themselves.

THE COURT: I will permit it.

A They present the logical processees, as Mr. DeRensis said, that are self-evident, namely, the selection of, you know, the model, derivation of equations to describe it. It presents the logical processees in that respect.

Q Do any of those exhibits tell us how that logic was applied in the computer?

MR. DE RENSIS: Your Honor, again, the exhibits speak for themselves.

THE COURT: No. Let him answer.

A Not in the exhibit, but I did testify --

Q I refer you to the exhibits. Do any of the exhibits --

MR. DE RENSIS: Your Honor, we will stipulate that the computer program is not in those exhibits, if that is what he is seeking to do, so we can save time.

THE COURT: All right.

MR. LAGEMANN: I didn't ask whether the program was, sir. I asked whether there was anything indicating the logical processees employed in the machine.

THE WITNESS: Could I have the whole question read

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back?

[Record read.]

MR. DE RENSIS: I object. Now we have two questions.

THE COURT: I assume you mean computer machine.

MR. LAGEMANN: Yes, sir.

MR. DE RENSIS: Can we know which question he is answering, the first or the second.

THE COURT: They are both the same.

A Beyond what is self-evidence, the major logical process I named in testimony, the method of integration, but it's--

THE COURT: The answer is that it is not completely set out there, isn't that correct?

THE WITNESS: Yes, sir.

THE COURT: All right. Next question.

Q Do any of those exhibits contain a non-technical explanation with illustrations of controls built into the computational process which were used to maintain accuracy and completeness?

MR. DE RENSIS: Your Honor --

THE COURT: Sustained.

Q Do those exhibits contain a system flow chart?

A No, they don't contain a system flow chart.

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MR. DE RENSIS: Your Honor, I object.

THE COURT: He answered no, it doesn't contain a system flow chart.

Q Do those exhibits contain a program flow chart or logic block?

MR. DE RENSIS: Your Honor, I object.

THE COURT: They do not. It's very obvious. They speak for themselves.

Q Do those exhibits contain the symbolic program?

MR. DE RENSIS: I object.

THE COURT: Sustained.

Q Did you employ a test deck in running these simulations?

A I would like to have a definition of a test deck.

Q Was there a separate deck of cards, sir, that was used to check the computational processees as they were being run in the computer?

MR. DE RENSIS: Your Honor, I object to the word, "separate." Are we talking about two decks of cards?

THE COURT: Apparently what we are talking about is two decks of cards.

A No, I just -- I used -- I ran the simulation and I judged its results from an engineering standpoint.

THE COURT: You did not have a test deck?

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THE WITNESS: If I understand what he means by test deck. In other words, I wasn't checking the computer or anything like that. I was using -- I simulated the device and as an engineer I knew what I thought it ought to do. The results made sense and I believed them.

Q What machine language did you use?

MR. DE RENSIS: Your Honor, I will object. What relevance does that have?

THE COURT: I have no idea. I will sustain it.

Q Did you use a simulation language?

MR. DE RENSIS: Your Honor, again, it's the same question. I object again. What difference does it make?

THE COURT: I tend to agree with you. I will sustain it.

Q Are there different languages, sir, some of which pertain particularly to simulation?

MR. DE RENSIS: Your Honor, I object.

THE COURT: I will take the answer that there are different languages which can be used. Is that correct?

THE WITNESS: Yes, sir, there are simulation-type languages available.

Q Did you use one of those simulation languages, sir?

MR. DE RENSIS: Again, I object.

THE COURT: I assume he did in order to make a

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simulation. Where are we going?

MR. LAGEMANN: I am not sure, your Honor, he did.

THE COURT: Where are we going? You think he didn't, is that it?

MR. LAGEMANN: No. I don't know. It might make a difference.

THE COURT: All right. Go ahead.

A Maybe I should say I did it in Fortran, IBM Fortran.

Q Is IBM Fortran one of those special simulation languages?

THE COURT: I don't know where this is going at this point. I don't think it's necessary. I will sustain the objection.

Q What make and model machine was used at Avco, sir?

MR. DE RENSIS: Your Honor, I object.

THE COURT: I will permit it. Go ahead.

A Avco computer services has an IBM 360, System 360, Model 75.

Q Did Avco have any procedure or technique to verify the operation of that machine?

THE COURT: If you know. You were just buying time, right?

THE WITNESS: Yes, that's right. I went to Avco and I did my work.

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Q Is the answer, sir, that you don't know whether they had any procedures or techniques to verify the operation of that particular machine?

A Well, yes. Now that you are getting into computers as opposed to engineering and dynamics --

MR. BENBOW: Will you keep it up?

THE COURT: Mr. Benbow, will you stop yelling. If you have to, move down here.

A Such a machine would catch what they call parity, which is generally indicative that something electrical has gone wrong with the machine, I believe. I am not a computer designer or anything like this. I am just exposed to it.

THE COURT: The question is, did Avco check out the machine, to your knowledge.

THE WITNESS: To my knowledge, they trusted their machine when they sold time to the public on it.

THE COURT: All right, fine. You don't know.

MR. LAGEMANN: Your Honor, at this time the defendant would like to move that Plaintiffs' Exhibits 123, 124, 125, 127, 128, 129, 132, 133, 133-A, 134 and 135 be stricken from evidence upon the following grounds:

First, there has been absolutely no foundation laid for the admission of these exhibits as a computer

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simulation. We are absolutely in the dark as to the program, the computational processees required. All that we know is that formulas were written, constants were used. They were put into the machine and something came out. We do not have any way of verifying the inputs against the outputs on any of these exhibits.

Secondly, your Honor, there is a rule of evidence that when tests and experiments are conducted that advance notice thereof and an opportunity to participate should be afforded the opposite party. The Second Circuit has said as much in Fortunato v. Ford Motor Company. No notice was provided here and certainly no opportunity to participate in the processees of this test or experiment, if such it be.

We also oppose it upon the grounds that if these simulations are an experiment, your Honor, that there has been no foundation laid by plaintiff as the proponent of these experiments, as it is required to do, showing substantial similarity of conditions between the experiment and the circumstances at the time of the litigation.

If this is a test, your Honor, and plaintiff hasn't made clear how he offers these simulations, there is absolutely no authentication foundation laid in that we don't know what happened to the inputs between the time that they

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were inputs and the time that they became outputs.

And as I have already indicated before, your Honor, we oppose this on best evidentiary grounds.

Your Honor, we have prepared a memorandum of law in support of this motion. I am handing counsel for plaintiff a copy of this. I am handing a copy to the Clerk of the Court. We would appreciate if your Honor would review this memorandum of law before giving us a ruling.

THE COURT: Have you seen this before?

MR. DE RENSIS: Never.

MR. LAGEMANN: Your Honor's misfortunes of the weekend, as I understand it, gave us an opportunity to prepare and research this memorandum.

MR. DE RENSIS: Your Honor, could I make one or two points now and then have a chance to study this.

THE COURT: If you are going to reiterate them this afternoon when you have a chance to do it, why don't you do it all in one shot?

Under the circumstances, I am going to take an early break for lunch, which will give you an opportunity to at least have a chance to read the memorandum and do some research if you consider it necessary.

See you back here at two o'clock. This afternoon, gentlemen, I expect that we will sit a little late so we can

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make up some of the time. If possible, I would like to get Mr. DeVilliers out of here today.

Do you have any further cross-examination, Mr. Lagemann?

MR. LAGEMANN: Your Honor, we are now at the point in the cross-examination of Mr. DeVilliers where we can go no further without the omitted data, being the program, the logical flow charts, the block diagrams, this sort of thing. Beyond this point we may have a few additional questions, but we really cannot proceed further.

THE COURT: All right. I will see you at two o'clock.

[Luncheon recess.]

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AFTERNOON SESSION

2:15 p.m.

THE COURT: Mr. De Rensis, I assume that you wish to address yourself to the memorandum which was submitted.

MR. DE RENSIS: Thatis correct, your Honor.

May I proceed?

THE COURT: Sure.

MR. DE RENSIS: First I want to point out that in this brief it is stated "There are apparently no reported opinions setting forth the foundations required for admission of omputeranalysis."

There is no law on the subject. What we are talking about here is really the application of common sense.

Now, the focus of this brief is that the simulations that were prepared by Mr. De Villiers are somewhat tests or experiments, thus at page 6 of the memorandum it is stated, "The simulations, however, may be considered experiments insofar as they attempt to recreate a condition or a situation as it existed in early 1965 or as a test showing the performance characteristics of a specific piece of equipment."

Based on that, the brief contains arguments

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such as, plaintiff should establish "the chain of possession and unchanged condition from the taking of a sample to the performance of the analysis."

I think the focus of the brief misses the purpose for which the simulations are offered.

Mr. De Villiers was asked to analyze and determine the viability of a concept, of an idea. He did an analysis and as part of that analysis he did what he called a simulation of that concept to determine whether that concept was viable.

He testified that it was viable and that his opinion was based on engineering analysis and on computer simulations.

He did not test any specific piece of equipment to determine the performance characteristics of that particular piece of equipment, nor did he attempt to recreate a condition or a situation as it existed in 1965.

Rather, the simulations are an analysis.

Moreover, Mr. Goor utilized the study to determine whether the concept could be developed, could be marketable and profitable.

In other words, the particular sizing of components is not important here. The particular dimensions are not important because the premise is that these could be

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changed.

Rather, what is at issue here is whether this idea, the idea of Frank Perrino, is a viable idea.

Thus, the cases and the references in the brief are really irrelevant.

The brief also contends that the simulation are inadmissible for want of notice and opportunity to participate.

Again, this is on the assumption that this is an experiment with similar conditions or tests, such as a chemical test. But even assuming that notice was required, defendant did propound certain interrogatories to us, and we answered them as early as November of 1973 by letter, in which we stated we intended to use a simulation.

Singer never followed the formula which it says is now required. It never asked to participate, never proposed to participate, never sought to participate.

They also say that such tests and experiments can only be done by "independent experts," and they say that Mr. Goor and Mr. De Villiers were hired by plaintiff and therefore cannot claim to be independent experts.

While it is true that Mr. Goor and Mr. De Villiers were retained by plaintiff, they were retained like any other expert, to provide their professional opinion.

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The brief further states that the simulations are inadmissible because they are not the best evidence.

Now, the best evidence claimed is actual tests of specific pieces of hardware. Again, that misstates the purpose for which these simulations are offered. The simulations are not a test of a particular piece of equipment manufactured by the Singer Company or Worcester Stamped Metal; rather, as stated before, they are an analysis, they are a determination of viability of an idea.

Finally, the memorandum cites a study, a report of the American Bar Association sub committee on data processing of the Committee on Agency rate making of the section of administrative law of the American Bar Association, dated 1964. This is a 10-year old study, apparently never adopted by any court. It relates and is designed to relate to proceedings before an administrative agency. It refers to agencies who could possibly run their own computer work. It relates to rate making functions where economic data of a regulated industry could be put into a computer, that is, historical data relating to a particular industry could be in the computer.

That is a very different thing than an engineering analysis and mathematical equations which were put into this computer.

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To restate what I said before, the simulations are not meant to be historical. They are meant to be an engineering analysis.

So again, we are dealing with suggested procedures relating to historical kind of data.

THE COURT: You mean to say that the ABA study talks about historical study?

MR. DE RENSIS: Yes.

THE COURT: All right.

MR. DE RENSIS: Another point here is Mr. De Villiers has come here, has prepared the computer simulation that we are talking about here, and has testified at length about how he prepared it, what that simulation consists of, the inputs that he derived from it, the way, the manner, the method of calculation used, and, indeed, identified essentially all of what has gone into this computer. He has been available for cross examination and he has been cross examined at length.

He has testified on direct that essentially the role of the computer in this process was to solve equations that he wrote, to solve equations for certain co-efficient of friction surfaces, to solve equations for certain automobile speeds, certain conditions, and that the computer was used as a computational aid because it

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would be too time consuming, too difficult to do it without the computer.

So again, this is not a case of where vast bodies of economic data are stored in the computer and made available to rate-making agencies. It is not that case at all.

Rather, here we have, as I stated before, a man who has testified that the Perma device is a viable concept, is a viable idea, that it had potential of being an anti-skid device, and that his analysis was based on his engineering experience and this simulation.

So I suggest to the Court that the argument contained in this brief is essentially irrelevant because it does not deal with that kind of computer simulation but rather deals with the historical data kind of simulation.

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THE COURT: All right, Mr. Lagemann.

MR. LAGEMANN: Your Honor, I am afraid we must take strenuous exception to most,if not all, of what Mr. DeRensis has stated.

Your Honor, the ABA report does refer to rate cases in administrative agencies. However, it shouldn't need much repetition that evidentiary rules are less stringent in agencies than they are in Courts of Law, and irregardless, the same principle applies. The reason it does is we are dealing here, your Honor, with a computer. We don't know what happened to the information that was put into the computer, if, indeed, it actually was put in at all. We don't know the sub-computations that were made. We don't even have the formulas, for example, for the weights of the governors. We don't have the printout of that.

What we don't know, your Honor, and it's hard to argue negatives, is everything that went on after the data was entered into the computer. We don't even know what analytical or logic flow took place. All we know is some data was in one place, it was put into a machine, maybe, and something came out.

This was a problem that the American Bar Association saw or foresaw, as the case may be, in its report. Contrary to what Mr. DeRensis states, rate making cases involve

projections of the effects of new rates or proposed rates if not historical. Of course, it involves historical inputs, but the purpose of computer studies in such situations is, of course, looking toward the future, and, of course, are created for the purpose of allowing the agency to come to a rational decision.

As the memorandum states, plaintiff has not stated very specifically, if, indeed, at all, the purposes for which it offers these simulations. The point is, however, they cannot be anything except a test or experiment. All tests involve analysis, an analytical process, for example. This, of course, is precisely what Mr. DeVilliers was doing in his simulation.

As regards any test involving analytical processees, as the memorandum points out, the chain of identity of that which is analyzed must be followed through the entire analytical process. This, of course, cannot be done without knowing the program sub-routines and logic flows of the simulation itself.

Finally we come to the point of notice. This entire problem, if you will, could have been alleviated had timely notice and an opportunity to participate been given. The Interrogatories to which Mr. DeRensis refers, in which he says notice was given, I did not find in our records.

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I cannot state for a fact such do not exist because I didn't look for them. As far as I know, the first notice we had was a letter sent from Mr. DeRensis to me giving Mr. DeVilliers' qualifications, in which it was simply stated that Mr. DeVilliers was a simulation expert. If, indeed, that is notice in the sense the Second Circuit and McCormick says notice is required, it was untimely. The simulations were already well underway at that point in time, as, indeed, the testimony of Mr. Goor makes amply clear.

As regards the independence of Mr. Goor and Mr. DeVilliers as experts, it must be noted that the term independent expert as used by McMormick obviously refers to an expert appointed by the Court. Clearly Mr. DeVilliers and Mr. Goor do not fall within this category.

Thus, your Honor, the purpose of the notice and opportunity to participate cannot appear in this case except to militate against admission of these simulations.

Your Honor, I could go on. It would be repetitive of the memorandum itself. If your Honor has any questions I will be happy to answer them at this time.

MR. DE RENSIS: Your Honor, may I make just two points.

THE COURT: Sure.

MR. DE RENSIS: The first point is on November

30, 1973 -- this is Court Exhibit 1 -- Mr. Grand sent a letter to Mr. Lagemann setting forth what Mr. Goor was going to testify with respect to, and it says in that letter he was going to rely on simulated operation of the device.

Secondly, after that letter I believe Mr. Goor testified that the runs that are in issue here were in fact run after this letter had been sent to Mr. Lagemann and no request was made.

If I could make one more point, there was some reference in the brief to a case entitled Fortunato vs. Ford Motor Company. I would like to just explain to the Court what the facts were in that case because I think it explains what is meant by an experiment or a test.

In that case the plaintiff had been driving a vehicle across a bridge and pressed the cigarette lighter and the car went up in flames. It apparently was due to the location of the gas tank and the fact that there might have been a leak of the gasoline vapors into the car.

There was at the trial offered a test made by somebody who had a similar car, that is, the same year car. There was no written report of that test. There was no opportunity for anybody to participate in that test. There was no showing that that car was the same as the other car. Therefore, the Court felt that there should have been notice,

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there should have been an independent test. I think that is dealing with an entirely different situation than what we have here.

MR. LAGEMANN: Your Honor, if I may --

THE COURT: In fact, just to fill you in on complete trivia, the present chairman of the board of Ford Motor Company got there partly through the development of certain patents concerning a connecting device for the gas tank in trucks and cars of that type. In fact, he has a patent on it, which is assigned, to obviate the situation brought up there.

MR. LAGEMANN: Your Honor, as regards the Fortunato case, I would commend your Honor to reading the case.

THE COURT: Oh, I will.

MR. LAGEMANN: I don't think the situation is really at all dissimilar to what is presented here.

As regards the notice, I believe it has been quite apparent through the testimony of both Mr. DeVilliers and Mr. Goor that the initial stages of this simulation were commenced in the late summer, early fall of last year. Presumably this is when the underlying activity went on. I have forgotten precisely the date of admission of defendant's Exhibit 127, but I believe it was around the earlier portions of December.

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THE COURT: There are indications that the program was being developed in August and early September, is that what you are saying?

MR. LAGEMANN: Yes, your Honor.

THE COURT: I assume, by the way, Mr. Lagemann, that you have, in the alternative, asked for the entire program developed by Mr. DeVilliers.

I assume, Mr. DeRensis, that you object to that.

MR. DE RENSIS: We have objected to that before.

THE COURT: I know. I just want to make sure of the positions.

MR. LAGEMANN: If I may address myself to that point, your Honor, it is our position that whether or not the program is provided at this point in time, these tests are inadmissible for want of notice and an opportunity to participate in the development of them and in the running of them.

THE COURT: All right. I am not going to decide the thing right now. I will let you have my decision sometime tomorrow.

April 25, have you given any thought to what is represented in 132 and what is represented in the computer?

MR. LAGEMANN: Objection.

THE COURT: He can tell us whether he gave any thought to it. I assume you have.

THE WITNESS: Yes, I guess I'm kind of losing the question here.

MR.LAGEMANN: I am sorry, I couldn't hear.

THE COURT: He said he lost the question.

Will you read the question, Mr. Reporter.

(Question read.)

A Yes, in both places I represented the dynamics of the vehicle that is shown on Exhibit 132.

THE COURT: The question basically is, is there anything other than wind drag which is represented in the computer which is not represented on 132?

THE WITNESS: Well, the stuff we got into this morning about the friction slip curves shown, the computer model will allow large angles, larger angular displacements to take place in the body, et cetera.

Q Did you prepare the formula for friction slip curves?

A Yes, we have it in the briefcase over there.

THE COURT: Now, is that what we talked about

this morning?

MR. DE RENSIS: Yes, they asked for it.

May we have this marked for identification.

(Plaintiff's Exhibit 143 was marked for identification.)

BY MR. DE RENSIS:

Q Are these the formula and numbers that you used with respect to your friction slip model?

MR. BENBOW: If he knows.

THE COURT: All right. Go ahead.

A Yes, these are the formula. Also the brake model is in there, too, I notice, that they were interested in, and the road -- the numerical data for the coefficients of friction, et cetera, is also in there.

THE COURT: I assume you are going to offer this, Mr. DeRensis.

MR. DE RENSIS: Yes.

THE COURT: Let me ask you this before you do. Do you have any other questions of this witness?

MR. DE RENSIS: Two more questions.

THE COURT: All right. Why don't you show it to defense counsel, the exhibit, and then we will take the two more questions. You can ask them after we are finished with a ten-minute break.

[Recess.]

MR. BENBOW: Your Honor, before we resume, might I inquire as to the request you made of Mr. Grand at Page 3834 of the record last Thursday when we adjourned. You there indicated that on Monday he should let you know what

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Q Mr. DeVilliers, you have before you Plaintiffs' Exhibit 143 for Identification, do you not?

A Yes.

Q Where did you prepare that document, sir?

A Where?

Q Where.

A Most of it right here in the building today over lunch hour.

MR. DE RENSIS: I object, your Honor. That is not relevant.

THE COURT: It doesn't much matter. You prepared it today someplace in the building?

THE WITNESS: Yes.

Q When you prepared that document were you referring to any other documents?

A Some notes I had from the past that I found in my briefcase.

Q Did those notes pertain to slip as used in the simulations?

MR. DE RENSIS: Your Honor, I object to this on the grounds of relevance.

THE COURT: Let's find out where it's going. Go ahead.

A They were work notes, you know, scratch notes.

Q What were they work notes concerning, sir?

A They were work notes from -- let's see. I almost wrote these formulas from memory, but I wanted to verify and I had some old paperwork from years ago in which I had some reference to it, you know, what was in there. So I looked and I was right, so I wrote it down.

Q Did the paperwork that you were referring to or the worksheets or notes refer to computer simulations that you

had worked on in the past or, indeed, to this particular computer simulation?

A The notes that I got this off of were when we were originally -- when I was originally developing the vehicle model.

Q At Kelsey-Hayes, sir?

A Yes. Just scratch paper.

MR. LAGEMANN: Your Honor, initially I would oppose the admission of Plaintiffs' Exhibit 143 for Identification on the best evidence ground.

The witness has already stated he has contemporaneous documents in his possession here in court and here he is offering us something else. I would oppose it on that ground.

THE COURT: Is that the ground of your objection?

MR. LAGEMANN: There may be others, your Honor.

THE COURT: Go ahead. What are the others?

Q Mr. DeVilliers, did you use the same formula in all of the runs on different coefficients of friction surfaces?

A These friction slip equations, you know, this stuff I have written for you here, covers the gamut.

Q Did you use it on the runs on a .15 mu surface?

MR. DE RENSIS: Your Honor, I object. Isn't that

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MR. LAGEMANN: Your Honor, one more point. In the motion we made to strike plaintiff's exhibits, we would like to include the new exhibit, of course, which contains the slip formulas within that motion.

THE COURT: Oh, sure, part and parcel of the whole thing.

MR. DE RENSIS: That is 143.

THE COURT: Well, it doesn't matter. Go ahead.

A No.

Q Did you appoint your engineering staff man, Mr. Herbst, H-e-r-b-s-t, to the task force?

A That's H-e-r-b-s-t, and the answer is no.

Q Did you give any assignment to the task force to verify the qualifications of the Elizabethport people who were involved with the Perma project?

MR. BENBOW: Objection, your Honor.

THE COURT: No, I will permit it.

I assume you mean the engineering staff at Elizabethport who were involved, right?

MR. DE RENSIS: Yes.

THE COURT: Engineering or technical staff.

THE WITNESS: I made no specific assignment to evaluate the competence of anyone involved with this particular case, including the Perma people.

Q Were you ever advised as to the reason for the behavior of the test vehicle at the demonstration you witnessed in June 1965?

A I do not recall any specific recitation of what caused the demonstration that we observed perform as it did, no.

Q Do you recall any discussion about o-rings being

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Q On Page 3608 of the transcript, Mr. diScipio, you stated, in partial response to a question of mine -- my question was, "What did you do or say?"

Down on Line 17 you continued your answer by saying, "I volunteered the hypothesis that any safety device as a minimum, if it failed, should leave the vehicle no less safe than had it not been so equipped."

A Yes, sir.

Q "At that time I believe it was characterized by me or someone else as a fail safe mode of operation."

That is your meaning of fail safe, right, sir?

A In this particular instance, yes, your Honor.

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Q And would that deal with any item in the automotive after-market?

A I am not sure I can speak for every item in the automotive market. It is my judgment, even today, that if a company offers a safety device, that at no time should the person's life be more jeopardized by having that device on his vehicle than if he does not have it on his vehicle.

NO MATERIAL ON PAGE A-894

THE WITNESS: They were located at the Elizabeth factory.

MR. GRAND: This is not the --

THE WITNESS: Well, at that time I think they were all at Elizabeth. I'm not sure.

Q In 1963, Mr. Romel, did your position at Singer change?

A Yes. In 1963 I was assigned to the Engineering Sales Section as the supervisory engineer. This section handled all the contract work. This would be work other than sewing machine parts, and we worked exclusively on contract type of work.

Q Until when did you continue in that capacity?

A 'Til 1966, I believe.

Q Would it refresh your recollection if I suggested September of 1964, Mr. Romel?

A Well, in September of 1964 I was promoted to manager of Engineering Contract Sales, yes.

Q Thank you.

Before turning to your responsibilities in 1964 as supervisory engineer of sales engineering, I would like to return briefly to your studies at Newark College of Engineering.

Did there come a time when you received a degree

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in Newark College of Engineering?

A Yes, sir. I received my degree in June of 1964.

Q And what was that degree?

A It was a Bachelor of Science in Mechanical Engineering.

Q During your studies at Newark College of Engineering, did you take any courses relating to design of machines or devices?

A Yes,sir. I took Machine Design 1, Machine Design 2, Kinematics and Kinetics, drafting design and design geometry. And there probably were some others, too, that I don't recall right now.

Q During your study at the Newark College of Engineering, were you elected to any honorary societies?

A Yes.

In 1963 I was elected to the National Honor Society of Mechanical Engineers.

Q And were you elected to any other societies? Let me ask this: I know of a group called Pi Tau Sigma Engineering Society. Was that the same group?

A That was the same group, yes.

Q Would you tell us generally what the Pi Tau Sigma Engineering Society is?

A Well, it's a society of mechanical engineers who

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THE COURT: Did he tell you to go to the meeting?

THE WITNESS: Yes, sir.

THE COURT: Okay. That is what I figured was coming out. So you went to the meeting, right?

THE WITNESS: Right.

THE COURT: Go from there.

A At the meeting, Mr. Perrino was there, and he went through -- he gave a talk on some of the background of the device. He said that the device had been tested since -- I don't remember the date, 1956, seven or eight years of

testing, and they had done a lot of tests in their laboratory; they had performed independent tests; and he told me that it was currently under evaluation by the major automobile companies.

He described in general terms how the unit worked and told me at that time about the fail-safe features and that the system had several backup features in case one failed, the other one would take over, and they would always return the system back to its original braking condition.

He showed me and had with him, and passed out, a considerable amount of literature which also described -- it was promotional literature -- described the unit and so forth and so on.

He had with him a quantity of the Motor Vehicle Research Group of New Hampshire.

He referred to this, in describing how the unit cycled, and he said that the device would prevent the wheels from locking and sense road conditions and so forth -- sense friction on the road.

I discussed with him some of the reasons for working with Singer and he told me at that time that he had a great deal of problems relative to quality, that he had quality problems with his present suppliers and that he was anxious to get someone else involved in the manufacturing that could

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exercise better quality control.

He told me he had a number of these units already in the field that had been sold and was in production, with the Swank people, I think it was.

That's about all I remember of the meeting.

Q You referred in your general answer to documents which were brought into the meeting. Do you recall what those were?

A They were various publications. I recall one from Dupont.

THE COURT: Well, first of all, the Motor Vehicle of New Hampshire report was there?

THE WITNESS: Right, that was there.

THE COURT: You said there was various other promotional materials; and you think there was one from Dupont.

THE WITNESS: Yes.

THE COURT: Does anybody have one from Dupont? Show it to him and ask him if that is the one.

Q Let me show you Plaintiff's Exhibit 20 in Evidence and see if that includes any document to which you referred.

A This is one of them, yes.

MR. BENBOW: Maybe Mr. Grand has the original? It might be a little easier. May I? Thank you.

Q Here, try the original, if you would, Mr. Romel. We are used to bad documents, but there is no reason why you should be.

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A Yes, these are the documents that were shown and distributed. This one is from Automotive News. I recall that. This is the Dupont one.

Q Referring to a part of Plaintiff's Exhibit 20?

A This also was a Perma piece of literature which was presented and distributed at this meeting.

THE COURT: That is also a part of that same exhibit.

A And the next one --

Q When you say, "this one", will you refer to titles on each for us, Mr. Romel? It will make our record clearer.

A Well, the Perma promotional material says, "No slip, no slide, no skid, straight, smooth control stopping with Perma anti-skid control," and then the literature inside describes how the unit works and so forth.

The next document is publication from the Fleet Owners. This was also part of the literature that was shown. I don't remember this last one.

THE COURT: You don't remember the last document?

THE WITNESS: No.

THE COURT: In Plaintiff's Exhibit No. 20, which is a bulletin from the, I don't know, Casualty Assurety Company, a motor vehicle bulletin, 110 William Street. Okay.

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THE WITNESS: There was also the New Hampshire Motor Vehicle Research Report.

THE COURT: Right.

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4/1 am

Q Is that what has been marked in this case as Plaintiff's Exhibit 19?

A Yes. That's about it.

Q Not all of Plaintiff's Exhibit 20 was available at that meeting? You have gone through it and tried to identify those that you saw at or about that time; is that right, Mr. Romel?

A That's correct.

I believe there were a great deal more than what's shown here.

Q These were some of them?

A They were some of them, yes.

Q Were there also sepias or blueprints at that meeting in April?

A Yes. The engineers that were working on the cost estimate were working with them.

Q Did you read the articles in Plaintiff's Exhibit 20 to which you have referred, at that time?

A No.

Q Did you read them shortly thereafter?

A Some of them I read briefly, but I don't think I really looked at them in any detail until after some time between June -- after June, at least. Throughout, from June to December of '64, I would say, I referred back to

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these at that time when we started experiencing problems and tried to get a better understanding of how this thing operated.

Q When you read the statements contained in these articles, did you believe them?

MR. GRAND: I object.

A Yes, I --

MR. GRAND: I object.

THE COURT: It couldn't matter less.

Q You have before you, Mr. Romel, Plaintiff's Exhibit 19 in evidence, that you have identified as the report of the Motor Vehicle Research of New Hampshire.

MR. GRAND: Can we get that stricken, your Honor, his belief?

THE COURT: Does it matter? It doesn't matter to me.

MR. GRAND: It matters, because it will be cited by Mr. Benbow in a post-trial brief.

THE COURT: All right. It will be stricken.

MR. BENBOW: We think his belief is most relevant, your Honor.

MR. GRAND: As I said, your Honor.

THE COURT: How?

MR. BENBOW: The affirmative defense.

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THE COURT: How is his belief relevant?

MR. BENBOW: He was acting on behalf of Singer. Singer relied on representations that were made to it by Perma. These were some of the representations. Whether the believed them would relate to the question of whether Mr. Romel and Singer relied or not.

MR. GRAND: He is dubious at this point.

THE COURT: Mr. Benbow, apparently you didn't hear his description of the literature. This was before the argument. He described the literature as strictly promotional literature, and strictly promotional literature, whether he believed it or not, is of no interest to me. He described it as promotional literature. So what do you want?

MR. BENBOW: I mightsay, your Honor, we have cited a case in our brief to the contrary of that proposition.

Q Mr. Romel, before the recess you were looking at

Plaintiff's Exhibit 19, which is the Motor Vehicle Research report. Would you look at that again, and in particular would you look at page 6, the right-hand column? Do you see a short paragraph there, I believe down towards the end of page 6, in the right-hand column, which states:

"The unit also employs failsafe features for added driver protection."

Did you believe that statement?

MR. GRAND: I object to this on a number of grounds.

THE COURT: Sustained.

Q Did you read this report shortly after the April meeting?

A I glanced through it. I don't believe that I read it in detail until some time later.

Q And when was that time later, if you recall?

A Somewhere around September, '64.

Q And at that time did you note the paragraph to which I have just referred you?

A Yes. I read it athat time.

Q And did you believe it at that time?

MR. GRAND: Objection.

THE COURT: Sustained.

Q Didyou believe it at all times --

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MR. GRAND: You didn't hear the objection.

MR.BENBOW: I am asking a different question.

MR. GRAND: You are asking the same question.

THE COURT: Please sit down. The objection is sustained.

Q Did you believe that statement on September 21, 1964?

MR. GRAND: Objection.

THE COURT: Sustained.

Q Do you recall if at the April meeting Mr. Perrino and Mr. Mainelli discussed the operation of the device?

A Yes; they did.

Q And did you discuss with them the operation of the device?

A They explained the device to me. I just listened.

Q Do you recall what they told you about the performance of the device?

A They told me that the unit offered steering control which would enable to operator to steer away from any objections and people and so forth, which it wouldn't have without the anti-skid device on the vehicle.

They also told me that it would stop the car in a shorter stopping distance on all road conditions with the device on the car as opposed to the vehicle without an

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anti-skid device.

He also told me that the device wasfail-safe, in that it had a number of fail-safe features incorporated in the design and that it would return the system to normal braking in case of any failure of the unit.

Q Did you believe those statements?

MR. GRAND: I object.

THE COURT: Sustained.

Q Did they say where they had gotten this information?

MR. GRAND: I don't understand that.

THE COURT: Well, do you understand it?

THE WITNESS: Yes.

THE COURT: All right. Go ahead and answer it.

A Well, they described the great deal of testing that had been done by their own engineering people and at the Motor Vehicle Resarch group. This, they said, was an independent testing laboratory that they went to to confirm their own positive findings when they tested the device at their own facility and at airports and on roads and so forth, and at the Motor Vehicle of New Hampshire, independent laboratory, confirmed the results that -- confirmed their good results.

Q What did they tell you about the state of

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development or testing of the device?

A Well, they told me it had been tested by their own staff; it had been tested by this independent testing laboratory, that endurance tests had been performed, and they had achieved mileages in excess of 100,000 miles and that there was still some tests being performed, and all of this information was going to be presented in book form by the Motor Vehicle Research group at some later date.

Q You mentioned what they said about production and where it stood in terms of production and marketing.

Do you recall anything else they said on that front?

A Well, only that, again, they had been in production and were experiencing quality problems and that they needed somebody to perform a better quality control job.

Q What else, if anything, do you recall that they said with respect to the concept of fail-safe?

MR. GRAND: I object. It has been asked and answered. I could read the whole thing.

THE COURT: Was anything else said about fail-safe

THE WITNESS: Yes. Frank went into quite a bit of detail.

THE COURT: You mean Mr. Perrino?

THE WITNESS: Mr. Perrino. I'm sorry.

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THE COURT: That's all right. We've got to get the record straight.

He went into quite a bit of detail on this?

THE WITNESS: Yes. He described, for example, if something happened in the mechanical system and it failed, the pressure would always drop below the pressure switch setting, and therefore the solenoid would always return the system back to normal braking.

He described how the governor was a fail-safe feature, in that at high speeds the governor would always keep the rotary valve in the atmospheric position, and thereby you would have your normal braking capability.

The cam gear was described as a fail-safe feature, in that it would always return and disarm the system.

The pressure switch was described as a back-up fail-safe feature, which would always open when the pressure was dropped and return the system back to normal braking.

Q Mr. Romel, you testified about a number of statements by Mr. Perrino at this meeting. At the time Mr. Perrino made these statements, did you believe them?

MR. GRAND: Objection.

THE COURT: Sustained.

MR. GRAND: I object.

THE COURT: No. I will permit it.

Go ahead. Answer it.

A No; he did not.

Q Mr. Romel, do you recall attending any other meeging, either a Singer internal meeting or with Perma present, prior to June 18, 1964, with regard to the Perma device?

A Yes. There was another meeting.

THE COURT: With whom?

THE WITNESS: Well, this was a meating relative to the showing --

THE COURT: No. Don't tell me that. Just tell me with whom.

THE WITNESS: These were Singer people, and I believe that Mr. Perrino and Mr. Mainelli was down, also. They brought a film down with them.

THE COURT: When did this meeting occur?

THE WITNESS: I think it would be somewhere in May of '64.

THE COURT: All right. Goahead.

Q Do you remember any of those Singer people who were there, Mr. Romel?

A Some of them, yes.

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Q I would like to hand you Defendant's Exhibit 1 and ask you to review that, if you would, Mr. Romel.

Do you recognize that as a transcript --

MR. GRAND: I object. If you want him to identify it, let him identify it , not you.

MR. BENBOW: It's in evidence.

MR. GRAND: It doesn't matter.

MR. BENBOW: I am asking him --

MR. GRAND: I object.

THE COURT: Wait a minute. We can cut this short.

Is there more than one movie of this product? Does anybody here know whether there was more than one?

MR. BENBOW: I did not see more than one, your Honor.

MR. GRAND: I gather only one, your Honor.

THE COURT: So the one movie that had already been seen you saw.

All right, does that stipulate it? There is only one movie, right?

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All right. Go ahead. You don't have to bother with that. Proceed. That's just a transcript of the movie. Go ahead, Mr. Benbow.

MR.BENBOW: Thank you, your Honor.

Q Do you know how Singer came to be in possession of this ~~phone~~ film, Mr. Romel?

MR. GRAND: I object.

THE COURT: Do you know? Yes or no?

THE WITNESS: Yes.

THE COURT: You do.

All right. You said you thought Perrino and Mainelli were there, and you think Karp also was there? Did they bring it with them?

THE WITNESS: Yes.

Q Why did they bring it down.

MR. GRAND: Oh, I object.

THE COURT: Sustained.

Q I note in the film transcript there are certain statements, if you look at it again, Mr. Romel, regarding the fail-safety, the testing and perfection and performance of the device.

At the time that you viewed the film, did you believe the statements contained in the sound track of the film to be true and accurate?

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MR.GRAND: Object.

THE COURT: Sustained.

Q Would you look at page 119 in particular of Defendant's Exhibit 1. The first full paragraph there states:

"The Perma" --

THE COURT: He can read it for himself.

Q Do you see that statement,Mr. Romel?

A Yes; I do.

Q About the Perma anti-skid control?

A Yes.

Q Did you believe that to be true?

MR. GRAND: Objection.

THE COURT: Sustained.

By the way, it should be noted in the record that the witness had the exhibit open to 119, which paragraph is also marked.

Go ahead.

Do you know where to go to next?

THE WITNESS: No.

Q Would you look at page 114.

Do you see the statement down toward the bottom of the page, which reads:

"This remarkable" --

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THE COURT: No. Let him read it.

Q (Continuing) And thereafter, Mr. Romel?

A Yes; I do.

Q Did you believe that statement?

MR. GRAND: Objection.

THE COURT: Sustained.

MR. BENBOW: Your Honor, I am not trying to burden the Court with repetitious questions to which you are sustaining objections, but I do believe that this particular witness' belief with respect to these statements is relevant and proper at this time, because he was the one at the engineering level who reported to senior management about the device, and the beliefs of management with respect to it were importantly determined by Mr. Romel's belief, and therefore that is the reason it seems to me what the state of that belief was, whether true or false, was relied on by Singer management and is appropriately part of this record, your Honor, so if there is some way I can rephrase those questions --

THE COURT: You have seen those statements. Did you make any evaluations at any time prior to December as to whether the device was fail-safe?

THE WITNESS: No, sir.

THE COURT: You didn't?

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THE WITNESS: No.

THE COURT: That's the way to do it.

THE COURT: When did you get the authority?

THE WITNESS: Around September 1, 1964.

THE COURT: All right.

After that time, did you check to ascertain whether the device -- whether the system had back-up features?

THE WITNESS: No. Under the --

THE COURT: No. Just answer yes or no. You did not?

THE WITNESS: I would like to explain to you why, because this was --

THE COURT: I don't care right now. You've got counsel. All I want to do is bring this out.

THE WITNESS: I did not try to verify what I was told about the device and what was presented in the various literature.

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MR. BENBOW: Your Honor, I dn't mean to press, so that we can plan on further stages of our direct case, have you had an opportunity yet to consider further our motion to strike with respect to exhibits that were used in connection with the testimony of Mr. De Villiers?

THE COURT: Well, I want to read some more of your cases?

MR. BENBOW: Thank you, your Honor.

We received a letter from Mr. Grand on that subject over the weekend, your Honor. Would you like us to address our comments to that at this time?

THE COURT: No. I think basically it is a reiteration of what he said in court.

MR. BENBOW: We disagree with certain portions of that letter, and if it becomes important to do so we would like tan opportunity to address ourselves to that.

THE COURT: If you would like to do that, go ahead.

MR. BENBOW: May Mr. Lagemann do that?

THE COURT: Surely.

MR. LAGEMANN: If your Honor doesn't have a copy of the letter before him --

mpbr 2

THE COURT: I don't need one. Go ahead.

MR. LAGEMANN: Briefly, your Honor, we apologize for not having sent a counter letter, but we received this on Saturday.

THE COURT: That's all right. Don't worry about it. Tell me why you disagree with it.

MR. LAGEMANN: At the outset, your Honor, it must be noted that this letter contains only counsel's"musings and observations", upon reading certain portions of the transcript. It does not and cannot contain a single citation to an authority which might tend to support Mr. Grand's reflections upon the law. In the absence of such citations, it must be assumed that Mr. Grand's observations are unsupported by any legal authority whatsoever.

Mr. Grand's letter contains --

THE COURT: Mr. Lagemann, I used to work for a man whose favorate sayingwas, "Don't assume a gosh-darned thing". Don't assume anything.

Go ahead.

MR. LAGEMANN: It is an assumption, your Honor, that we would like to make.

THE COURT: Go ahead.

If you want to make it, make it.

MR. LAGEMANN: Mr. Grand's letter contains what

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we believe to be an astonishing argument, that the simulations reflect only Mr. De Villier's judgment as to the performance of the anti-skid device. This confirms our view that the simulations, if your Honor deems them admissible, are nothing more than self-fulfilling prophecies of the first order ~~water~~.

Mr. Grand, however, does state in his letter that the simulations are an analysis of the Perma device and somehow concludes from this that these simulations are neither tests nor experiments. The logic of this argument I find bewildering. All tests involve experiments and analysis of what is tested.

Mr. Grand's argument is that the notice was given and that the defendant waived its right to participate in the preparation and conduct of the simulations.

Once again, I note that plaintiff has cited no authority, legal or otherwise, for this proposition.

I submit that no such authority can exist, for a number of reasons:

First, there was no notice. There is a prescribed form for notice in this and other courts. There are rules prescribing the manner in which such notice will be served. Mr. Grand's letter to me of November 30, 1973, can meet neither criterion.

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The notice was, of course, utterly untimely.

As Mr. Goor and Mr. De Villiers have indicated in their direct testimony, these simulations began in late summer of 1973 and were partially if not totally completed by November 30, 1973.

Plaintiff was, of course, obliged to give notice of them before it did any work whatsoever on these simulations.

Finally, and most obviously, plaintiff's notice, if indeed the November 30th letter was such, did not offer or hint at an opportunity to participate. It is our position that the Mc Cormick and Fortunado case makes clear plaintiff's obligation to offer this. It is not defendant's obligation to demand it.

The simulations were all completed at the time that letter was written and sent.

Finally, some notice must be made of the next to the last paragraph in Mr. Grand's letter of May 3rd, 1974. Once again, plaintiff makes it clear that it will not disclose the program. Plaintiff had an earlier opportunity to do so and declined at that point in time as well. It is our position that this refusal can indicate only that an examination of that program by an expert would clearly show bias in the program in favor of making the Perma

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device work.

At the prior occasions, when we asked for production of the program, Mr. Grand indicated that the program would not be provided because it was proprietary to Mr. De Villiers and to Goor Associates as well. This contention is, of course, absurd. The vehicle and friction models were admittedly taken from the Kelsey-Hayes Company. If that portion of the program is proprietary, it has to be proprietary to Kelsey-Hayes and certainly not to Goor Associates.

The model of the Perma device or the portion of the program that pertains thereto would not be, it would seem, proprietary to Perma.

MR. GRAND: The program can't --

THE COURT: Go ahead.

MR. LAGEMANN: It is Singer's position that the simulations are inadmissible because of the lack of notice and opportunity to participate as well as plaintiff's failure to lay a foundation, and because of the best evidence rule.

This is not to say, however, that if the simulations are deemed admitted by your Honor the defendant will not demand the program and other relevant information of plaintiff.

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THE COURT: All right, Mr. Lagemann. What is a computer?

MR LAGEMANN: Your Honor, I am not a computer expert and --

THE COURT: In pure Mother Goose language, what is a computer?

MR. LAGEMANN: A computer is a machine that will make computations in accordance with instructions given to it.

THE COURT: It is a big calculator with a storehouse memory; is that right?

MR. LAGEMANN: Yes, which will make calculations strictly in accordance with instructions given to it.

THE COURT: If you are going to push the wrong key, it will give the wrong answers?

MR. LAGEMANN: A computer goes beyond that. A calculator is programmed for only a few routine functions.

THE COURT: That is why I say it has a storehouse memory.

MR. LAGEMANN: A computer can do anything with numbers that anybody can dream up for it to do, and itwill do it in the order and sequence that the programmer has told it to do. It is not where you push an add button and be sure that it will add something absent

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knowledge of a program to add.

THE COURT: All right.

MR. LAGEMANN: One final point, your Honor: It should also be noted that if the motion to strike is denied, the defendant will have to hire an expert witness to analyze plaintiff's simulations and the program which created it, and perhaps if we deem it or if that expert deems it necessary, to conduct our own simulations on our own behalf.

THE COURT: The record should reflect that there were two experts sitting in the courtroom throughout the entire testimony: Mr. Goor and Mr. De Villiers, both of whom were passing notes to Mr. Lagemann and other members of the defense.

MR. LAGEMANN: Your Honor, as the record indicated many months ago, one of those experts is Mr. Stanley I. MacDuff, who is a mechanical engineer and who has no computer experience whatsoever. The other expert was a Singer employee, a Singer scientest, who could not be hired, we feel, as an expert to testify in this case, because of his employment.

We would therefore have, your Honor, to obtain another expert witness to go forward in that eventuality.

THE COURT: All right.

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Do you want to reply?

MR. GRAND: No.

THE COURT: All right, Mr. Benbow.

A L B E R T E. R O M E L, resumed.

DIRECT EXAMINATION CONTINUED

BY MR. BENBOW:

Q Just before lunch, Mr. Romel, I think I asked you what if anything you did when you got the drawings. Would you respond, please?

A I reviewed the drawings for completeness and used them to develop a parts list. I found that at that point in time --

MR. GRAND: I don't think he has been asked what he found.

THE COURT: No. He developed a parts list.

A (Continuing) In order to develop the parts --

MR. GRAND: There is no question.

THE COURT: Just hold on.

THE WITNESS: I am sorry.

THE COURT: Go ahead, Mr.Benbow.

Q What did you find at that time, Mr. Romel?

MR.GRAND: I object. I don't understand. He has't been qualified as a finder of anything.

THE COURT: No. Go ahead.

A I found duplications and missing information in regard to what components constituted the major sub-assemblies.

MR. GRAND: Didn't we have this this morning?

THE COURT: Perhaps we did. Go ahead.

Q Would you look, Mr. Romel, at Plaintiff's Exhibit 22 which may still be before you from this morning, which is a memorandum or the meeting of March 13, 1964. Let me direct your attention to the statement that a bill of material has been furnished by Perma to Singer. It was in fact a billof material furnished prior to the June contract?

MR. GRAND: I object.

THE COURT: Sustained.

Q Would you turn your attention, Mr. Romel, to page 2 of that memorandum, the third paragraph, and explain to us what you understand that to be referring to.

MR. GRAND: I object.

A That --

MR. GRAND: I object.

THE COURT: Let me see that.

Is Mr. K. Heffer an employee of Singer?

THE WITNESS: That's correct.

THE COURT: Go ahead. You don't need any further information.

THE COURT: All right. Go ahead.

Q Can you list in detail what you did in developing a parts list, Mr. Romel?

A Well, we had a unit stripped down and tried to identify the parts with the parts prints, and where there were duplications or omissions --

MR. GRAND: I object. I don't have any idea of who "we" is and when this was taking place.

THE COURT: Who was "we"?

THE WITNESS: Myself and several of the engineers at --

THE COURT: All right. When did this happen.

THE WITNESS: This was right after the contract.

THE COURT: All right. A week or two after June 18th; is that right?

THE WITNESS: Yes.

THE COURT: All right. So you stripped down the device and tried to identify each part with one of the drawings; is that correct?

THE WITNESS: That's correct.

THE COURT: Go ahead.

And I assume that some time you listed the parts?

THE WITNESS: Yes.

THE COURT: Did you want it in any more detail tha..

THE COURT: Okay. Tell me, where did you get the numbers, or where did Mr. Gomes get the numbers for the various filters on there? There are four different numbers given, right?

THE WITNESS: These were on the sepias and parts prints that we received.

THE COURT: Okay.

Q Did every part have a sepia or a blueprint?

A No.

Q Did that affect the operation of your quality control people?

MR. GRAND: I object. We are not talking about third parties.

THE COURT: Sustained.

Q Did you discuss this matter with your quality control people?

MR. GRAND: What matter? I object.

THE COURT: Do you want to specify; what matter?

MR. BENBOW: Yes.

Q The matter of parts and blueprints.

A Yes, sir.

THE COURT: Generally? All right.

THE WITNESS: Yes.

Q What discussions did you have?

Q Can you describe in general, Mr. Romel, I believe was the question I asked you, the type of testing which was done under the June contract?

MR. GRAND: ~~Gain~~ Again I object. I still think there is no foundation for this man's knowledge.

THE COURT: No. I will permit it. Go ahead.

Q Well, we tested the individual sub-assemblies. For example, the Perma-Vac would be placed in a test stand, and we would follow the sequence and procedure that was outlined by Perma, and that would be to subject the unit to hydraulic pressure, take readings; subject the unitto vaccum, take readings of the pressure drop and make sure it had dropped to zero, and then re-introduce atmospheric pressure into the rear chamber and take a reading on the pressure output.

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We would also take a reading as to when the continuity light, which would indicate that the pressure switch was open -- this would be observed.

On the sensing unit, the sensing unit was placed in the stand and connected to a drive cable and spun up to a hundred miles an hour equivalent. It was attached to a Perma-Vac unit that was part of the test stand, and we went through a sequence whereby when you pressed a button, the motor -- it had a clutch motor on it -- would automatically simulate a brake application, which would indicate --

THE COURT: A brake application or locked wheels? Which one?

THE WITNESS: Locked wheels.

THE COURT: All right.

THE WITNESS: This would indicate to the unit that there was a locked wheel condition, and the sensing unit governor would collapse, introduce vacuum into the rar chamber, and you would take a reading to see that it dropped to zero, that the continuity light went out and then returned back to its original state.

This was repeated three times.

THE COURT: On each and every one?

THE WITNESS: Yes, sir.

THE COURT: All right.

Go ahead.

THE WITNESS: There was no test for the gear box at all specified.

When we did get our pressure switch test stand completed, that test included setting of the switch by the operator, whereby you would set the opening pressure of the switch and record the readings.

All of these major sub-assemblies were then turned over to quality control, and they sample inspected the units.

THE COURT: All right.

Go ahead, Mr. Benbow.

MR. GRAND: The only time we have for this is June to December.

THE COURT: Jun to December; yes.

Q Did Singer do any performance testing between June 18, 1964 and December 21, 1964?

MR.GRAND: Your Honor, we are assuming that this man is the repository of all Singer knowledge.

THE COURT: If he knows.

(To the witness) Do you know?

THE WITNESS: Yes; I do.

A There was no performance testing of the entire unit. The only test that was performed in a vehicle was in very late December.

THE COURT: After December 21st?

THE WITNESS: No. It was just before, I think.

THE COURT: All right.

THE WITNESS: And this was related to a question that arose that Mr. Perrino posed to me as to whether our test stand was adequate or not. So Mr. Mainelli told me to put some gauges in a car and take a unit and test it on a test stand, record the pressure readings and see if the same readings were obtained in the car, and that's about all we did.

THE COURT: And this was in late December of 1964?

THE WITNESS: That's right.

THE COURT: But before December 21st?

THE WITNESS: That's correct.

THE COURT: All right.

Q Did Singer do any testing or analysis of the fail-safety of the deisgn between June 18, 1964 and December 21, 1964?

MR. GRAND: Your Honor, I object to what Singer did. I have no objection to what this man did.

THE COURT: This is the man we are talking about.

MR. GRAND: That's right. Then I think the question is objectionable as to form.

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I want to be perfectly clear that we are talking about this man and not about Singer.

THE COURT: All right.

(To the witness) Do you understand? Did you do anything?

THE WITNESS: No. I had no reason to do anything.

MR. GRAND: I object to what his reasons were, and I move to strike it.

THE COURT: The motion is granted.

THE COURT: I think I know what Mr. Benbow is trying to get at. Let me see.

(To the witness:) Did you ever do any theoretical studies as to design of the Perma device prior to December

21, 1964?

THE WITNESS: No, sir.

NO MATERIAL ON PAGES A-934-5

talking about.

THE COURT: Well, it's pretty obvious that Mr. Romel introduced a number of modifications into the gear box from the time it was originally given to you, until the time that you got one to go to a hundred thousand miles; right?

THE WITNESS: That's correct.

But the basic concept of the drive, basically remain the same.

THE COURT: Okay.

Q Did the modifications that you made to the existing gear box improve its wear characteristics?

A Yes, they did.

Q Did there come a point in time when Singer was convinced that the gear box could give a stisfactory longevity in their performance?

MR. GRAND: Objection.

THE COURT: Did you become convinced as opposed to Singer?

THE WITNESS: Yes, I did, your Honor.

THE COURT: Okay.

MR. BENBOW: I maintain he was Singer for this matter.

MR.GRAND: Fine, tell him he was Singer.

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Q When was that, sir?

A That was some time in November, I believe it was, or December, '64.

MR. GRAND: Can we get it definitely?

THE COURT: November or December '64. That's the best he can do.

Can you do it any better than that?

THE WITNESS: Not without specifically identifying test data.

MR. GRAND: He has documents in front of him.

THE COURT: Would those documents help you, the ones you have in front of you?

MR. GRAND: He has got 118. Just look at 118.

THE COURT: Let him look.

MR. BENBOW: I will show him what I like, Mr. Grand, if I may.

Q Showing you Defendant's 233 for identification, I ask you if you can identify that.

A Exhibit D-233 is a memorandum from me to Mr. Broeker, dated December 23, 1964, and attached to it is the summary of test results on gear boxes dated December 21, 1964. In the covering letter --

THE COURT: Don't tell us hat is in it. That's enough for now. You signed it, right?

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A It was typed that day. It could have been prepared before then, probably.

Q You say it could have been. But it also could have not been, is that correct? Do you have any specific recollection as to when this document was prepared by you?

A What time of day?

Q No.

THE COURT: No, no. What day? Was it December 21st or --

THE WITNESS: I can't tell you now.

THE COURT: If you can't remember, that's the very best answer.

Q But not until two days later, December 23rd, did you send that document in a covering memoranda to Mr. Broeker, is that correct?

A That's correct.

Q As of December 21, 1964, had you conducted any tests indicating a life of a hundred thousand miles of any gear box?

A No.

Q In fact, the maximum on this document is 69,000, correct?

A That's correct. We continued running the other ones.

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Q Did you have any problem with respect -- let me see if I can refresh your recollection -- to the switches repeating on test stands, Mr. Romel?

A Pressure switches?

Q Yes.

A No, sir. This was in relationship to the cam gear which was earlier.

MR. GRAND: What was that?

THE COURT: The question was could he have a pressure switch repeat on the test stand, and he answered no. He said you could do that with a cam gear, and that happened earlier, right?

That is basically what you said, isn't it, sir?

(No response.)

Q You referred this morning, I believe, to a cocking problem, Mr. Romel. How was that problem resolved?

THE COURT: We have been through it three times now.

MR. GRAND: Three times.

THE COURT: This is the plastic guide that Mr. Romel went down and made down in the tool room.

Q And when was that work completed, if you recall?

A Some time in October.

Q And was the cocking problem solved as of that time?

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that had been stored at Worcester were made by American Optical?

THE WITNESS: Yes, I believe so.

THE COURT: And you ran into problems there?

THE WITNESS: Yes.

THE COURT: Tell us what the first problem was.

THE WITNESS: The first problem was that we accidently discovered that there were cam gears hanging up. This was accidently found because --

MR. GRAND: Nobody has asked him his reasons for finding it.

THE COURT: We don't care. You found that it hung up.

Q Prior to that problem, Mr. Romel, didn't you testify yesterday that you had a problem of beehive strings?

MR. GRAND: I object to his contradicting his own witness. The witness testified that the first problem was the cam gear.

MR. BENBOW: Can't I refresh his recollection?

MR. GRAND: He hasn't said he needs refreshing.

THE COURT: Absolutely, you had cam gears hanging up first, right? Is that right?

THE WITNESS: That is correct, yes.

THE COURT: What did you do to correct it?

THE WITNESS: Well, I notified Frank Perrino that we were having a problem because I really didn't know what the significance of this was.

MR. GRAND: I object to his little self-serving asides, what he understood and what he didn't understand; I move to strike them.

THE COURT: Motion to strike granted.

THE WITNESS: I notified Mr. Perrino.

THE COURT: How did you do it, by phone?

THE WITNESS: Yes.

THE COURT: About when? Later June, early July?

THE WITNESS: No, I think it was August.

THE COURT: August, okay. What did you say to him and what did he say to you?

THE WITNESS: I told him that we had discovered a condition on the test stand whereby the sensing unit kept repeating, and that according to the test procedure this was not supposed to happen, and he talked about the quality of the parts and so forth, to check those out, so forth and so on, which we subsequently did.

He then said he was coming down to Elizabeth, and shortly after that I had a discussion with him.

I took ~~told~~ him to the test stand and demonstrated the

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condition. We then had a discussion and he requested that we take the units apart.

We took the cover off of the sensing unit, and Mr. Perrino said that the reason why it was hanging up was that the cam surface was not smooth enough.

So I got the drawing out of the file and looked at the drawing, and there was no finish specification on the drawing.

I told him that this was a sintered iron part, and since there was no specification for finish, that the finish would be that from which the process would yield.

He then asked me, you know, we got into discussion -- he said, well, it has to be smooth.

I said, well, you know, we can't tell or give instructions to somebody and just say it's got to be smooth. We have got to have a way of measuring how smooth you are talking about. And we had this discussion.

He said, well, how smooth can you make it?

And I said, well, I don't know.

I said -- he said, well, why don't you polish some for me and then measure them and see what the reading is and, you know, we can try them out, and if it doesn't hang up, we can specify that as a specification.

So I told him that I would do this. However,

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I did not recommend doing this because a hand polishing operation on a cam surface of that nature would be --

THE COURT: This is what you told him?

THE WITNESS: Yes.

THE COURT: Okay.

THE WITNESS: It would be difficult to control in manufacturing, and also very difficult to measure. But I told him that I would make -- polish some and try them out.

The next thing that I did was to sit down and perform some calculations on force diagrams, vector diagrams.

I knew what the spring -- he had told me what the spring force was and from these calculations I determined that the angle should really be changed because it was a marginal design situation.

The next time Mr. Perrino was down, I had another discussion relative to these changes.

By that time I had polished some cam surfaces.

He also requested that we cut down the stop, so that the pin would hit the stop more abruptly and then cause it to bounce back.

I had some cams silver soldered and cut that down, polished them, and put them on the sensing unit stand, and activated the stand.

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I found that in the case where they were polished and with the cut down stop, there were no more hang ups.

So I told Mr. Perrino what the results were. I also told him that in my opinion we should change the angle.

So, what did he say to you?

THE WITNESS: He told me that he agreed, but this would entail redesigning of the parts of the micro switch spring and so forth, and that he had done a great deal of development work in this area, had spent many, many hours developing just the right spring combination, and that he would consider this for the future.

However, at this point in time he wanted the cams polished, and he wanted the mold changed to shorten the stop.

THE COURT: But not change the angle, is that it?

THE WITNESS: That's correct.

Basically, this was the extent of our discussions at that time.

THE COURT: All right.

THE WITNESS: We had later discussions about this point.

THE COURT: When you say later discussions, you are talking about after December?

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THE WITNESS: No, prior to December.

THE COURT: Prior to December?

THE WITNESS: Yes, your Honor.

THE COURT: All right, tell us what those discussions were. Where were they? Still Elizabethport?

THE WITNESS: At Elizabeth.

THE COURT: You don't get to travel at all, do you?

THE WITNESS: Not very much.

THE COURT: Okay.

You had further discussions. When were these?

THE WITNESS: Well, these were shortly after I wrote a memorandum to Mr. Fecko regarding the test procedures and what prompted me to do this was this cam gear hang-up.

THE COURT: You still had the cam gear hang-up?

THE WITNESS: No, but I started thinking in terms of the fact that since a test was not specified to detect this, there might be other defects that we should be testing for that were not specified as a test.

THE COURT: All right.

So what did you do?

THE WITNESS: I wrote a letter to Mr. Fecko and informed him that perhaps maybe there were things that we should be testing.

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MR.GRAND: He is now telling us the contents of a document.

THE COURT: I think so.

MR. GRAND: The document is in evidence, your honor.

THE COURT: Is it in evidence?

MR. GRAND: Yes.

THE COURT: Okay. All right, we have got it. You haven't seen it, but I have. Go ahead.

Anyway, you had a conference with Frank Perrino, is that correct, at some point?

THE WITNESS: That's right. I was instructed by Mr. Fecko --

THE COURT: I don't care what happened with Fecko. You had a conference with Perrino. What did you tell him?

THE WITNESS: Well, I told him that I had been thinking about what had happened on the --

THE COURT: On the cam gear hang-up?

THE WITNESS: On the cam gear handup, and that there was no real test specified to detect this, and I said I was starting to get concerned about the fact that perhaps maybe there were other defects that should be tested, and I also started thinking in terms of the fact that since we were only testing portions of the device, independently, as sub-

assemblies, that it might be a good idea if we developed a simulation test stand which would test the entire system before it was packaged, so that we knew that all the sub-assemblies would interact correctly with each other.

THE COURT: What did Mr. Perrino say to you?

THE WITNESS: He said that this wasn't necessary. He said that he had done all the testing that was necessary, endurance testing. He said he had a test by an independent lab. He said the unit was fail-safe and that --

MR. GRAND: All this is in response to what he just said?

THE WITNESS: Yes.

THE COURT: Yes.

THE WITNESS: He said that he didn't think that we should build such a test stand and, well, I had requested information from him regarding what additional aspects we should be testing, and he said that even in the case of a gear hang-up, he said, there's fail-safe features that back that up; for example, at high speeds, he said the governor would always keep the unit in the normal braking mode, and that at the lower speeds, the pressure would drop below the pressure switch, and it would --

THE COURT: Cut out?

THE WITNESS: Cut out, but that it would probably

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pump on a normal stop or at the end of the stop, and from a marketing viewpoint, he said, this was undesirable, but it was not an unsafe condition.

So I abandoned the idea of going any further. I believed what he told me.

MR. GRAND: I move to strike what this fellow believes.

THE COURT: Strike that.

MR. GRAND: Or believed.

THE COURT: Yes, that is stricken.

Go ahead. Do you want to ask another question?

MR. BERBOW: If I may. I would like to show him, in connection with his previous response, PX 39.

Q Is this the memorandum to Mr. Fecko to which you referred in your prior response?

A Yes, it is.

THE COURT: What's the date on it?

THE WITNESS: It's dated September the 17th, 1964.

Q Prior to December 21, 1964, Mr. Romel, did Mr. Perrino ever tell you that the design of the Perma device was perfected?

MR. GRAND: I object.

THE COURT: Was what?

MR. BENBOW: Was perfected.

THE COURT: No, I will permit it.

MR. GRAND: Haven't we had it a number of times?

THE COURT: I think so. Go ahead.

A Yes, he did.

Q On how many occasions?

A On many occasions. He was always --

MR. GRAND: No, before we get "always", can we get the occasions specified and who was present?

THE COURT: Yes. Start the first one.

THE WITNESS: The first time was in April 1964.

THE COURT: Okay. The second time was when? That

was at that meeting, right?

THE WITNESS: Yes, your Honor.

THE COURT: The second time was when?

THE WITNESS: The second time was during our discussions relating to the cam gear hangup.

THE COURT: The third time?

THE WITNESS: Was when we discussed the erratic pressure switch readings, just prior to the change of the addition of the contact guide.

THE COURT: Any other times you remember?

THE WITNESS: Around November or December, when we had discussions relating to the low pressure output of the Perma-Vac unit, and also somewhere between October and December there were discussions relating to o-ring leakage in the Perma-Vac.

THE COURT: Into the Perma-Vac?

THE WITNESS: In the Perma-Vac; the cylinder bore, past the o-rings and into the chamber.

THE COURT: Okay.

Q What did Mr. Perrino say to you in April?

MR. GRAND: I think we have had that, your Honor.

THE COURT: That we have had. That much I know. Go on to the next one.

Q Beyond what you have already testified to with

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respect to April, Mr. Romel, and take your time in responding to my question, do you recall anything further that Mr. Perrino said to you on that occasion other than what you have already testified to here?

MR. GRAND: Your Honor, I don't understand. In addition, what is the relevance of this, since he is not the decision maker in Singer?

THE COURT: I understand that. Let's find out anyway.

Go ahead.

A You're talking about April?

THE COURT: Yes.

MR. GRAND: This is the all-day meeting he was present at for one hour.

THE COURT: Yes. Believe it or not, I remember what goes into the record.

MR. GRAND: I know you remember.

A I think I covered that before. I don't want to repeat myself.

THE COURT: Okay, fine. I appreciate that, by the way.

Go ahead to the next one.

Q You mentioned the cam gear hangup in September. I want, for the moment, to pass by that one and go --

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MR. GRAND: I don't think he put a date on it.

THE COURT: Yes, yesterday there was discussion as to the date.

Go ahead.

Q You said that you had a discussion with Mr. Perrino on this subject in connection with erratic pressure switch readings.

Would you tell us everything that you remember Mr. Perrino saying on that occasion or occasions?

A Well, I again had --

THE COURT: Can we have a date on this?

MR. GRAND: Time?

THE COURT: About when?

THE WITNESS: Around October, I think.

THE COURT: Okay.

A I told Mr. Perrino that we were having erratic pressure switch readings and that we had measured the parts. I couldn't understand why we could not -- the switches would not repeat. He insisted that --

MR. GRAND: Could we just get what he said and not this witness' characterizations?

THE COURT: All right, sit down. I don't want a speech. He said what?

THE WITNESS: He said that these were quality

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problems, there is nothing wrong with the pressure switch design, that it had been perfected, it was a pressure switch that he had developed prior to the anti-skid program, and that this was something that he was marketing as a separate item, and I again started questioning him in relationship to -- well, I had realized or had been thinking about the fact that --

MR. GRAND: Can we just have what he told Mr. Perrino?

THE COURT: All right. YOu said you were thinking about something or what?

THE WITNESS: Yes. I said that it appeared to me that there may be defects in the design, that we are not aware of, and that we are not testing for, and we should be perhaps re-evaluating what our test procedures were.

He said that this was not necessary, that the design was perfected, that he had done a great deal of testing and development work, that we had only to resolve some minor bugs with the device, and that we could go back into production immediately.

Q Anything else on that occasion, Mr. Romel, that you recall?

A No.

Q Let's go back, then, to what I think you said

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yesterday was a discussion of the cam gear hangup problem in September, and I may have further questions for you later on it, but I want to ask you now about what Mr. Perrino said to you, if anything, with respect to the perfection of the device.

A I told him that I suspected that due to the fact that we had accidentally discovered this cam gear hangup situation --

MR. GRAND: I think we had this very conversation yesterday.

THE COURT: Yes, I think so.

A -- that there might be other areas in the device which could cause a malfunction, and that I requested information relative to additional tests that should be performed in order that I could build a road simulation stand, and he said this was not necessary, the device had already been perfected, it was fail-safe. He had done all the testing that was required. He had testing done by an independent laboratory, and that I had nothing to worry about.

Q And now, you have testified that in, you think, November or December you had a discussion of perfectability with Mr. Perrino relating to low pressure output, I think you called it.

Would you tell us the entirety of your discussion with Mr. Perrino on that subject?

A Well, around that time we were experiencing very high reject rates on the Perma-Vac test stand. Virtually, we couldn't get any units past Quality Control. I suspected at that time that perhaps the --

MR. GRAND: I object to what his suspicions were.

THE COURT: Did you have a conversation?

THE WITNESS: Yes.

THE COURT: Tell us what the conversation was.

THE WITNESS: I told Mr. Perrino that I thought the spring ought to be changed. He told me that this was not necessary, that the --

THE COURT: Which spring are you talking about?

THE WITNESS: Perma-Vac spring, the large spring.

THE COURT: Yes.

THE WITNESS: That he had done a great deal of work perfecting the Perma-Vac, that the spring that was specified was an optimum spring, that it would take a great deal of work and effort to develop a new spring; he worked very closely with the spring suppliers, and that it was not necessary.

He said that there was something wrong with the test stand, there was nothing wrong with the design.

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THE COURT: What did you answer him, if you did?

THE WITNESS: Well, I really -- I told him I didn't agree with him, but he said it would be adequate, and after a lengthy discussion he said that 600 psi would be adequate to cover the braking situation, and he said that he would reduce the specification from 700 psi down to 600 psi.

Q Did Mr. Perrino tell you --

MR. GRAND: No, I object to this. This is leading this witness.

THE COURT: No, no, was there anything else in this conversation?

THE WITNESS: Yes. He said that I didn't really understand how the device worked, and that if I understood more clearly how the system operated, that I wouldn't be badgering him in regards to the possibility of requiring design changes.

He said that the device was perfected and it had several fail-safe features which he described.

THE COURT: Anything else?

THE WITNESS: No, I believe that covers that conversation.

THE COURT: Okay. Go ahead, Mr. Benbow.

Q Was anything said on the subject of locking

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pressure tests?

MR. GRAND: I assume this is the same conversation?

MR. BENBOW: Yes.

A There were no conversations relating to testing, but Mr. Perrino did say that the 600 psi was adequate to lock the brakes. He said the only condition that this probably would not handle would be in a case where a vehicle had a faulty brake system, which I thought was a reasonable thing, if the brakes were bad to begin with, they were bad.

MR. GRAND: I thought all this led into some pressure gauge tests at Singer in December.

THE COURT: It doesn't much matter. That is not what it is being offered for.

Go ahead.

Q You also referred, I believe, to a discussion or discussions sometime between October to December, I think you said, about o-ring leakage in the Perma device.

A Yes. This conversation centered around the fact that the bore of the Perma-Vac cylinders were a thousandth oversize in one particular lot, and we got into a discussion on what effect that would have on fluid leakage, and during this discussion we again got --

MR. GRAND: I assume we are talking about

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hydraulic fluid?

THE WITNESS: That's correct, yes.

A We got into a discussion about what the effect would be, Mr. Perrino said, well, that's a very remote probability. O-rings are used extensively in aircraft equipment, and it had been tested and cycled for cycles way beyond what the normal usage would be in actual application on the vehicle, and that would not be a problem.

Secondly, he said that if there was leakage that had occurred it would be a gradual type of thing which would be sensed by the operator of the vehicle, whereby he would sense a softening of the brake pedal similarly to when you lose fluid from your master cylinder or your wheel cylinders, that it just doesn't collapse instantly, and you recognize the fact that you have a gradual softening of the pedal.

MR. GRAND: Will you give us a date for that conversation?

THE COURT: We are going to get it from D-116.

MR. GRAND: The document is dated December 4th.

THE WITNESS: December 4th. It is around that time.

This was a sensing unit that was taken off the company's station wagon and grease and oil and particles and so forth were discovered in the housing. I called Mr. Perrino and we had a discussion.

MR. GRAND: Keep your voice up just a little.

THE WITNESS: We had a discussion as to what was the cause of this, and he said that the probable reason was the defect in the quality of the o-ring in the gear box, I think it was, that was supposed to prevent transmission oil from getting into the gear box and up the cable.

Q You may be getting off the track, Mr. Romel. I asked you this question only insofar as it relates to the representations by Mr. Perrino to you about the perfection of the device.

MR. GRAND: I object to that characterization.

THE COURT: We might as well have the whole conversation.

MR. GRAND: That's right.

THE COURT: Go ahead.

Q Go ahead, Mr. Romel.

A I asked him what the effect would be and he said that the only effect would be that the unit would become inoperable, and I said, due to the fact that there were foreign particles of metal which appeared to be shavings from the coupling in the microswitch area, that it would seem to me that there would be a possibility of these particles creating a short or a circuit contact at some

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point whereby the unit would be triggered.

He said that this was really nothing to worry about because of the fact that the system did have backup safety features, and that they would preclude loss of braking power and return the system back to normal.

Q Subsequent to your review of the documents that had been called to your attention by Mr. Perrino, and prior to December 21, 1964, did you make any analysis or do any testing with respect to the fail-safety of the device?

MR. GRAND: This has been asked and answered, your Honor.

THE COURT: No, I will permit it again. Did you?

THE WITNESS: No.

THE COURT: You know those lawyers; you stay away from them, right?

THE WITNESS: I will.

THE COURT: Don't; they're your best friends.

Q Mr. Romel, subsequent to your conversation with Mr. Kloby, did you attend a Saturday meeting prior to the signing of the December contract?

A Yes, I did.

THE COURT: Who was at the meeting?

THE WITNESS: Mr. Murphy, Mr. Broeker, Mr. Hough, myself, Wagner, Sprague, Kloby-- I think Patten was there, too.

THE COURT: How about Sharp ?

THE WITNESS: Yes, I think he was there, too.

Q When did this meeting take place, approximately, Mr. Romel?

A A couple of weeks before that contract was signed.

THE COURT: Early December '64?

THE WITNESS: Yes, second week, something like that. I don't know.

THE COURT: Okay.

Q Do you recall if there were other people there beyond those that you have already named?

THE COURT: In other words, let me try --

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THE COURT: I will let it go in. Go ahead. Did anybody tell you what the purpose of this meeting was?

THE WITNESS: Well, they told me that the meeting was called to ascertain the status of the Perma project. It was in reference to the possible signing of the second agreement.

THE COURT: Okay.

Q And did the statu: of the project include the technical status of the project?

A Yes, this was the purpose of me being there.

shareholders, and therefore it becomes an admission. Otherwise, it doesn't come in.

MR. BENBOW: Your Honor, I think there is one part of it that clearly does come in, and that is --

Q Were you instructed to do anything at the meeting itself?

THE COURT: Okay, that I will allow.

A Yes, I was.

THE COURT: What were you instructed to do?

THE WITNESS: To tell Mr. Murphy and Mr. Hough the status of the various problems that we had been experiencing. In other words, explain what problems we had experienced early in the program and tell them where we stood at that point in time in reference to those.

THE COURT: Who gave you those instructions?

THE WITNESS: At the meeting, Mr. Murphy told me to present the status.

THE COURT: And you presented the status at the meeting?

THE WITNESS: Yes, that's correct.

THE COURT: As you saw it.

THE WITNESS: As I saw it at that time.

THE COURT: All right, Mr. Benbow.

Q Did you describe the technical status of the

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Q Mr. Romel, will you please describe what in substance was said at the meeting?

THE COURT: No. Mr. Romel, you were requested to give some kind of a technical evaluation at this Saturday meeting, December something 1964, right?

THE WITNESS: Right.

THE COURT: And you stood up and said something, right?

THE WITNESS: Right.

THE COURT: All right. Maybe you did it sitting down. I don't really care. What did you say?

THE WITNESS: Well, I told Mr. Hough, Mr. Murphy and all --

THE COURT: The assembled luminaries.

THE WITNESS: -- the assembled people, I described the problems that we had with the wear on the gear box and told them that the latest test results indicated that we

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had basically solved the wear problem, that I was going to continue these tests until they terminated in failure to determine the maximum mileage, which I anticipated to be in the order of a hundred thousand miles, and the reason I gave for this was that --

MR. GRAND: I object to his reasons.

THE COURT: The reason you can't give. Tell us what you said.

THE WITNESS: I said that this was reasonable to expect because we were running these at constant speeds, high speeds, and that examination of them at this point in time indicated no wear.

I told them that we had experienced problems with high reject rates on the Perma-Vac unit, which was one of the reasons that had prevented us from producing units throughout the early part of the program, and that since the specification had been lowered from 700 psi to 600 psi that this problem appeared to be resolved, the production rates would be increased substantially because of this. I also said that Mr. Perrino had assured me that the 600 psi pressure was adequate.

I said that the sensing unit problem, which related to contamination, was still being wear tested, life tested, and that I did not view this at this time as a major

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problem because we had solutions that we were currently testing, there were a number of different solutions to that problem.

THE COURT: Did you tell them about the individual solutions?

THE WITNESS: Y :.

THE COURT: Tell us what you said.

THE WITNESS: I told them that the solutions were in terms of various types of wahers, teflon washers and so forth, which up until that time appeared to be doing the job.

I said that the earlier problems with the pressure switch had been resolved through a design change in the champfer on the bore and also a design change which stabilized the settings, the guide ring.

At some point there I was asked if there were any other problems that I hadn't spoken about and I said I didn't know of any other problems, that all of the known problems that had occurred in the past were either, in my opinion, resolved orwould be resolved shortly, within the next few weeks, with these tests that we were currently running.

THE COURT: That is the sum total of what you said?

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THE WITNESS: That is the substance.

THE COURT: That is the best you can recall right now, ten years later?

THE WITNESS: Yes.

THE COURT: All right.

BY MR. BENDON:

Q At that meeting was there any discussion as to the time when Singer might resume production?

MR. GRAND: I object.

THE COURT: Sustained.

Q Did you state at the meeting that the design --

MR. GRAND: I object.

THE COURT: Let me hear it.

MR. GRAND: First, he is leading the witness. He doesn't have to do that.

Q Did you state at the meeting that the design of the device was perfected?

MR. GRAND: Objection.

THE COURT: I think he has already testified as to all he can recall.

Did you make that statement?

THE WITNESS: I can't recall.

Q Did you state at the meeting that the device had been fully tested by Mr. Perrino's engineering staff,

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according to what he had told you?

MR. GRAND: I object to this practice. This is not the way to elicit direct testimony when a witness has already testified.

THE COURT: He is going to say he doesn't recall that or he never said it.

I will bet you money on it.

Go ahead. Do you recall saying that?

THE WITNESS: No.

Q Did you tell Mr. Hough or the meeting that the Perma device had been tested by an independent laboratory?

MR.GRAND: I object.

THE COURT: I will perm it. Go ahead.

The question is whether you stated that, Mr. Romel.

A Well, I did make a statement in regards to the question that was raised or posed to me by Mr. Hough as far as whether there were any other problems. I don't know if I could recall my exact statement, but in essence what I told him was that -- I believe I covered all the known problems and that I didn't have any access to any field or performance data, that if there were any other problems I wasn't aware of them.

THE COURT: You told Mr. Hough this?

THE WITNESS: Yes.

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THE COURT: Okay.

Anything else that you recall that you said at that time?

THE WITNESS: That I said?

THE COURT: Yes, that you said.

THE WITNESS: No.

THE COURT: Okay.

Go ahead.

Q What, if anything, did you say about Perma's testing of the device?

MR. GRAND: Objection. This is his evaluation he is reporting on, your Honor.

THE COURT: I am well aware of that.

That is outside of his evaluation, Mr. Benbow. I sustain the objection.

Q If it was presented as part of your evaluation.

MR. GRAND: I object.

THE COURT: I don't know how it could be presented as part of his evaluation. I will sustain it.

Q Did younot have occasion to refer to what Perma had done as well as what Singerhad done in making this evaluation to Mr. Hough and the others?

MR. GRAND: I object.

THE COURT: Sustained.

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Q Was there any reference by you to the subject of fail-safety or fail-safe features?

MR. GRAND: Object.

THE COURT: I think we have exhausted his recollection, Mr. Benbow. I don't know how else you are going to get into it. He has already said that before this December meeting he did no complete independent evaluation of the device.

Is that correct, Mr. Romel?

THE WITNESS: That is correct.

MR. BENBOW: He may have had occasion, however, to refer to the work of others or the statements of others, your Honor, and have reported that as fact to Mr. Hough and others.

And again, I am not offering this for the truth of what is beingsaid. Quite the contrary.

THE COURT: But we have had twice the statement that the man has told us everything he can remember about it. I have permitted you to lead him on a couple of things, and he says he doesn't recall.

Now, all of a sudden we are going to get into this. It seems to me like we have exhausted his recollection completely at this point.

MR. BENBOW: If I may try one more, your Honor?

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THE COURT: All right.

Q Did you say, if you recall, anything, in substance, about the present state of marketability of the device?

MR. GRAND: Objection.

THE COURT: Marketability? No, I will permit it.

MR. GRAND: He hasn't qualified him as any kind of expert.

THE COURT: I am well aware of that. We have an engineer here reporting upon engineering things, and now it gets into marketability. I don't know.

MR. BENBOW: If my question is not clear, your Honor, let me state it again, please.

Q Did you say anything which would indicate that the device in its present state was marketable?

MR. GRAND: Objection. To whom?

THE COURT: To the meeting, I assume, or marketable to who?

MR. GRAND: How can he answer that? Did you say anything which would indicate? Maybe to me it wouldn't and to you it would, Judge.

THE COURT: It may be a little sloppy in form, but let's see.

Did you say anything like that?

THE WITNESS: I don't know about the exact

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terminology, but I was asked whether or not the device at that point was ready for sale.

THE COURT: What did you say?

THE WITNESS: I answered yes.

THE COURT: You said yes?

THE WITNESS: Yes.

Q When did Singer resume production or assembly of Perma anti-skid units, if you recall?

A It was right after the contract was signed. I think it was in a matter of a couple of days actually.

Q After you had completed reading Defendant's 400 and the documents enclosed therewith, did you have a conversation with Mr. Perrino about them?

A Yes, I did.

Q Was this conversation by telephone or in person?

A By telephone.

Q Did you call Mr. Perrino or did he call you?

A I called Mr. Perrino.

Q Approximately when did this telephone conversation take place?

A Right around the end of January, I guess.

Q During this conversation, what did you say to Mr. Perrino and what did Mr. Perrino say to you?

A I said that I was very disturbed over the field reports that were included in Mr. Mainelli's information that he sent down, that I noted there were numerous brake failures, there were numerous statements regarding lagging, and that these field reports were during a period of time throughout 1964 and I was disturbed over the fact that he had never brought these things to my attention. There were statements regarding contamination of particles in the sensing unit and I said, "How come you didn't tell me about this? We had to find this out when we had these on the gear box stands."

He said that these were earlier units and that it was during the time where he was having quality problems, that these failures would not have occurred if the parts were made correctly.

I cited a few instances where the reports were relatively late in the year '64 and he said that the failures were related to the fact that the parts were not made correctly, that if they were made correctly that the fail-safe features would work, and I said, "What about your -- the comments made by your technician? There was one where he said, 'Let's put our heads together and come up with a device that is fail-safe', something to that effect." He said he didn't agree with his technician's analysis of

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the problem.

We talked about the concept or, you know, "What do you mean by fail-safe?" He said, "Well, nothing is a hundred percent fail-safe."

The conversation went back and forth. I was unable to get anywhere with this conversation.

MR. GRAND: I object and move to strike that.

THE COURT: All right. Strike that part of it. Go ahead. Just tell us what was said.

A We talked about the locking pressure tests also. I said that after reviewing these results that I was concerned about the fact that on some of these runs the locking pressure requirement exceeded the minimum 600 psi test specification and that it appeared to me that we could possibly have a brake failure because of this and it could result in an accident, somebody getting killed or something.

He said that the results, the high results, were attributed to the over-braking of the test driver, and we had another discussion similar to the one we had up at Attleboro. I pointed out to him that in his report there were some readings higher than 600 psi which were not asterisked and not explained in that respect and that in view of this I felt that we had better find out precisely what the requirements should be.

That's all I can recall at the moment.

Q At the time you received DX 13 for identification, Mr. Romel, from Mr. Patten, were you given any instructions?

A Yes.

Q Who gave you those instructions?

A Mr. Patten.

Q What instructions did Mr. Patten give you?

A He told me to analyze the failure modes contained in the letter and provide himwith information as to whether these statements were true and whether I agreed or disagreed with the analysis.

Q Did you in fact follow Mr. Patten's instructions?

A Yes, I did.

MR. GRAND: Are we talking about this is the first time he ever did a failure mode analysis on this project?

THE COURT: I don't know.

MR. GRAND: I just want to make sure we know what he is talking about.

Q Are these your notations on the side of the bar?

A Yes, they are.

MR. BENBOW: I would like, your Honor, to go through this handwritten notations one by one.

THE COURT: Let me ask you one more question. Was this the first time yo did an analysis of how the device could fail?

THE WITNESS: Yes.

This was the first time that Isat down and reviewed

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in detail from an analytical point of view.

THE COURT: All right, go ahead.

MR. BENBOW: Is it appropriate for me to reoffer the document, your Honor?

MR. GRAND: Why can't we ask him what he did?

THE COURT: Why don't you ask him what he did? It is simpler.

Q Would you tell us about the first notation that you made?

MR. GRAND: No, I object.

THE COURT: No, what did you do in this analysis?

THE WITNESS: I studied the analysis that was made by the duPont engineers and studied those in relationship to the device and reasoned whether or not from a theoretical point of view that these statements were true or whether it could happen, if a brake failure could occur if the condition that was outlined occurred, and I made notations to that effect on the document.

THE COURT: This is strictly on a theoretical plane you were doing this, right?

THE WITNESS: Yes. This would be without considering any probability, analyzing the system itself, if this happens, what is the effect, and so on.

THE COURT: I haven't read that document.

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Did you include anything other than what is in there as to a possible mode of failure, or did you restrict yourself to the things that the duPont engineers suggested?

THE WITNESS: At this point I restricted myself to answering Mr. Patten's request and that was --

THE COURT: Look at the stuff that the duPont people had done, right?

THE WITNESS: That is correct.

THE COURT: Okay. Included among the things there, is there anything about, well, take for example, the coupling between the -- does anybody have a Perma-Vac here?

MR. GRAND: You want the Perma-Vac?

THE COURT: Yes.

The coupling between the -- what is this called here?

THE WITNESS: That's the check valve housing.

THE COURT: -- the check valve housing and the brake line?

THE WITNESS: No, I don't believe there is.

THE COURT: Does it include a crack in the pressure valve?

THE WITNESS: No, it does not.

THE COURT: Okay, so you just restricted yourself to whatever the duPont people thought about it?

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THE WITNESS: That is correct.

THE COURT: All right.

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MR. BENBOW: Based on that testimony I would like to renew my offer, your Honor.

MR. GRAND: May I have a moment?

THE COURT: Sure.

MR. GRAND: I am going to continue my objection, your Honor. If it's necessary, your Honor, for the record to include precisely every failure mode he considered, I think he can tell us. The problem with this document is that it contains the conclusions of Dupont on a device, the generation of which we do not know. We don't know the qualifications of the person who did it.

I have no objection to this man telling us every last thing he did. I just don't want another witness here that isn't here.

THE COURT: All right. Why don't you tell us what you concluded. Maybe that would make it faster.

MR. BENBOW: May he utilize his notations for that?

THE COURT: Oh, sure. I can barely read them. God Bless You if you can!

I am not commenting upon your handwriting, I want you to know. It's just that that copy is a pretty terrible copy.

Q May I suggest, Mr. Romel, that you go through those

handwritten notations one by one and tell us what they say.

THE COURT: No, no. Don't tell us what they say. Tell us what you concluded in your analysis that brought you to make those handwritten notations.

A The first failure mode which relates to the plugging of the air filter, No. 65, this is the air filter which is on the sensing unit rotary valve.

MR. BENBOW: Just one moment, Mr. Romel.

MR. GRAND: You are probably better off to give him a unit.

THE COURT: Give him a unit.

MR. GRAND: Because we won't be able to see it.

Q Is it easier to use the unit or the diagram?

THE COURT: It doesn't matter, you know. At this point I practically have it memorized.

MR. DE RENSIS: This is 3 and 4.

THE COURT: This one is the rotary valve right here which could plug up, right?

THE WITNESS: No. It's the air filter. Now, this plugs and you have a vacuum condition in the Perma-Vac.

THE COURT: Then you continue with a vacuum --

THE WITNESS: You continue to have a vaccum condition, loss of brakes. So that statement I noted was true.

THE COURT: All right. Go ahead.

THE WITNESS: The second failure mode was the failure of the solenoid spring. Now, that is the spring that is internal in here.

THE COURT: I know what it is. Go ahead, next.

THE WITNESS: That would cause the rotary valve to remain --

THE COURT: In the vacuum open position?

THE WITNESS: -- vacuum open.

THE COURT: Okay.

THE WITNESS: The third failure mode was the entrapment of the governor spring between the telescoping shaft or the spool shaft and the governor drive shaft. That would be when this closes the coil would get caught in there.

I also noted that this would be a cause of a brake failure, would prevent the rotary valve from returning to the atmospheric position.

THE COURT: Can you hear this?

MR. GRAND: I hear it. There are a number of assumptions in there.

THE COURT: I am aware of it. Go ahead.

THE WITNESS: The fourth failure mode was welding of the contacts of the pressure switch could result in the

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inability of the unit to cycle with loss of braking and I said this was true. This would be a condition where the two silver contacts due to DC current arcing would weld onto the contact ring. This would prevent the unit from returning back to normal braking.

The fifth failure mode was the failure of the pressure spring.

THE COURT: Here?

THE WITNESS: Yes.

THE COURT: All right.

THE WITNESS: This would prevent the opening of the contacts and the braking of the circuit.

THE COURT: All right.

THE WITNESS: The sixth failure mode was the failure of the piston seals in the Perma-Vac, which would cause a loss of fluid.

THE COURT: What you are talking about is right here, right?

THE WITNESS: These two seals.

THE COURT: Okay.

THE WITNESS: I indicated that this was true also.

The seventh failure mode was jamming of the piston in the pressure switch, which is internal in here. It jammed in the -- while the switch was in the closed position.

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THE COURT: Then it remains in a closed position and you don't have it cutting out, right?

THE WITNESS: Right.

THE COURT: Okay.

MR. BENBOW: Your Honor, again, I would like to rene --

THE COURT: Let him go through it this way. It's faster.

MR. BENBOW: All right, fine.

THE COURT: What is your next?

THE WITNESS: Well, the next notation that I made was on the third page. This was in reference to the last paragraph, where it was stated that cyclic functional sequencing tests to determine both the system and component reliability had not been made. My notation here was true and this was based on the analysis of the information contained in Mr. Mainelli's documents which he sent me in January.

contained in the stopping distances that were measured. That was for a 30-mile an hour speed.

The next graph is the same type of graphical presentation for a speed of 50 miles an hour.

MR. BENBOW: That's the last page.

Q Can you tell us what the configuration of the unit or units was which were tested at Linden in early May 1965?

A They were a single psiton Perma-Vac with a half-inch diamter bore size.

Q And a transfer valve?

A A transfer valve with a leather diaphragm. There was also a dual piston Perma-Vac.

Q You used in Linden?

A Yes.

Q Can you tell us on which car which was used?

A It was used on an American Motors vehicle, I believe.

Q The dual?

A Yes, and also a Cadillac.

Q I thought we tested a Chevrolet station wagon and a Polara?

A We did.

THE COURT: And other cars.

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MR. GRAND: And other cars.

A The dual Perma-Vac also had a transfer valve with the leather diaphragm.

Q Who suggested the use of a leather diaphragm on the transfer valve?

THE COURT: That's already beentestified, Mr. Grand -- this witness.

MR. BENBOW: Yesterday.

Q Your idea?

A I am not sure. I think I had discussions with Mr. Perrion on this.

Q Were there any other characteristics about the anti-skid device that you haven't told us about which make it different from the device as it existed prior to December 21, 1964?

MR. BENBOW: Your HOnor, I raise the question whether this isn't beyond voir dire?

THE COURT: You want to get in the results of the tests; Mr. Grand wants to find out what kind of a device was being tested. It seems proper.

A Well, yes, all of the changes and improvements that were made up to that point in the program were in this design.

Q I assume that there were no restricter valves?

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THE COURT: When were they?

THE WITNESS: Shortly after the tests were made and --

THE COURT: Is this the first bunch of tests?

THE WITNESS: The second set.

THE COURT: The second?

THE WITNESS: Yes.

THE COURT: All right. Do you want to go into this right now, Mr. Benbow?

MR. BENBOW: I am ready.

THE COURT: All right, let's go. Tell us what he said to you and what you said to him.

THE WITNESS: He said the test results --

MR. GRAND: Can we at least have gotten Mr. Perrino a copy of the test results before he is telling Mr. Romel what they are about, since he wasn't there.

THE COURT: Did you send him one?

THE WITNESS: No. He called me and --

THE COURT: Did you tell him what the results were?

THE WITNESS: I told him what the results were. I said that there were substantially longer stopping distances noted and that I felt that in view of this that the program should be held in abeyance until such time we developed a means of achieving at least equal to or better stopping

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distances with the unit on.

He said that there were shorter stopping distances as well and he said --

MR. GRAND: I don't understand this, your Honor. Mr. Perrino doesn't have the document in front of him. How can he know except to the extent that Mr. Romel has told him'

THE COURT: That is what I gather he told him.

THE WITNESS: I told him.

MR. GRAND: All he has testified he told him is that they were substantially longer.

THE WITNESS: I told him there were also shorter stopping distance tests. He was aware of some of the results, because --

THE COURT: Was anyone from Perma at the second set of tests, if you know?

THE WITNESS: No, I don't believe so.

THE COURT: Continue with the conversation.

THE WITNESS: Well, he said that the results were inaccurate. He talked about heating the brakes between runs, and so forth, which could affect the stopping distances. He said that the method of observing the speed was very difficult for the driver to determine and could lead to inaccuracies.

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was a couple thousand dollars was worth retaining the services of him and his staff, and I told him that it wasn't a question of the amount of money, that it was a question of the level of engineering that was supplied and the validity of the information that was supplied that I was concerned with, and also the validity of the prototype being information that had been supplied, and that we would need a much better job done in this area if we were going to succeed.

THE COURT: Was anything else said, that you can remember?

THE WITNESS: Not that I can recall.

THE COURT: Okay, go ahead, Mr. Benbow.

MR. BENBOW: Thank you, your Honor.

Q Mr. Romel, did there come a time at Singer when you tested the Perma device with a resticter valve incorporated therein?

A Yes.

Q What is a restricter valve?

A A restricter valve is a fluid control valve which controls the rate of flow of fluid; in one direction it would change the rate of flow; in the other direction it would retain the same flow rate.

THE COURT: It would retain the same flow rate?

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THE WITNESS: In one direction the fluid would pass through more rapidly than in the reverse direction. In other words, you could control the rate of flow.

THE COURT: Do we have one of these devices around?

MR. GRAND: We have never seen one, Judge.

Have you noted one? Do we have one, Mr. Romel, do you know?

MR. GRAND: You won't find one on any Perma exhibit.

THE COURT: Okay.

MR. BENBOW: We will seek to obtain one, your Honor.

THE COURT: It doesn't matter.

Where did you put it?

THE WITNESS: It was placed between the Perma-Vac and the brakes.

THE COURT: Where does the brake line come in on this one?

THE WITNESS: Right here. (Indicating.)

So it would be --

THE COURT: On the side of the Perma-Vac, is that right?

THE WITNESS: Well, it was in the --

THE COURT: Or was it on the line?

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valve.

Q Was using the restricter valve your idea?

A Yes.

Q What was the intended purpose of the restricter valve?

A To reduce stopping distances with the unit in operation, to reduce the rate of pressure drop and reduce the amount of time that the vehicle would be in a free wheeling condition.

Q Was the Perma device with the restricter valve ever put into production?

A No.

Q Was this an experimental program?

A Yes, it was.

Q I believe you have testified that you tested the Perma device at Singer with the restricter valve incorporated therein. When did such testing occur, if you recall; about, Mr. Romel?

A I believe this was during May, right after -- some period of time after the Linden Airport tests.

Q What were the objectives of the tests at Singer on the unit with the restricter valve?

MR. GRAND: I object to this.

THE COURT: What were the objectives?

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MR. BENBOW: Yes.

THE COURT: He just testified he intended to cut down the stopping distances.

Did you have any other objectives than that?

THE WITNESS: No.

Q What, if anything, did the tests at Singer on the restricter valve demonstrate w th respect to stopping distance?

MR. GRAND: Objection.

THE COURT: You ran tests, right? Did you run them on a car?

THE WITNESS: Yes.

THE COURT: Okay. Was this another trip out to London?

THE WITNESS: No. This was at Singer, at low speeds.

THE COURT: What did you test? What kind of a car did you have?

THE WITNESS: '64 Chevrolet.

THE COURT: Going at low speeds, you step on the brake, right?

THE WITNESS: Right.

THE COURT: Do you have any test data from these tests?

THE WITNESS: Yes.

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THE COURT: Do you have it?

MR. BENBOW: Yes, your Honor.

Q I hand you a document which has been marked 285 for Identification, Mr. Romel. Can you identify that, please?

MR. BENBOW: That is Defendant's 285, of course.

A These are test esults.

MR. GRAND: How many pages do you have in your document, Mr. Romel?

MR. BENBOW: Four, I believe. You asked about pages, Mr. Grand?

MR. GRAND: Yes.

THE WITNESS: Four.

Q I think you were in the middle of an answer when Mr. Grand asked you that question.

A These are test results of stopping distances, using a hydraulic flow control valve. The first sheet has test data from May 26th, May 27th, May 28th, June 3rd.

Q Did the --

THE COURT: Let him finish.

MR. BENBOW: I'm sorry.

THE COURT: What's the second sheet?

THE WITNESSS: The second sheet is a duplicate of the first sheet.

MR. GRAND: With some handwriting on the right side.

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Whose handwriting is it?

THE COURT: Is there handwriting on it?

THE WITNESS: Yes. There are some notations on the side of the page.

THE COURT: Do you know whose that is?

THE WITNESS: No, I don't recognize the handwriting.

THE COURT: I don't know about your copy, but it is just a big blurr here.

Go ahead. What's the third sheet?

MR. GRAND: I see something which may say, "on, off" but beyond that I can't make it out.

THE COURT: Go ahead.

MR. BENBOW: Maybe your copy is better than ours, Mr. Grand.

THE COURT: Go ahead, what's the next page?

THE WITNESS: The next page is the tests with a flow control valve.

MR. GRAND: Is this June 5, 1965?

THE WITNESS: Dated June 5, 1965. It is with a fixed orifice or stem diameter.

MR. GRAND: Where do you see that?

THE COURT: It's right there on the document. It's pretty hard to read.

Can you read it on yours? Yours is better than ours.

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MR. GRAND: But I'm not.

THE COURT: You don't want me to comment on that, do you?

MR. BENBOW: Your Honor, to abbreviate the process, I only intend to offer the first page.

MR. GRAND: That's only going to complicate life.

THE COURT: It might complicate life. All right. What's the fourth page?

THE WITNESS: The fourth page is a summary of the tests taken on June 5, 1965.

THE COURT: Okay.

MR. BENBOW: The reason I stated my intention, your Honor, is that we don't know the origin of the handwriting. It is not a clean copy or very legible copy. What I thought I would do now is offer the first page and then subsequently hope to obtain a clean copy and, if necessary, offer --

THE COURT: No, if we are going to put it in, put it all in. Mr. Grand, do you object to it?

MR. GRAND: I want to know a little more about it.

VOIR DIRE EXAMINATION

BY MR. GRAND:

Q Did the tests that are reflected in Defendant's 285 run daily from May 26th through June 5?

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AFTERNOON SESSION

(2:00 p.m.)

A L F R E D E . R O M E L , resumed.

MR. BENBOW: May I proceed, your Honor?

THE COURT: Please do.

BY MR. BENBOW:

Q You will recall, Mr. Romel, that before the luncheon recess you testified with respect to restricter valve tests prior to the Route 80 tests which were subsequently conducted and I think we identified on the record certain exhibits which related to that testing.

Did the testing at Singer of the unit with the restricter valve between May 26, 1965 and mid-June 1965 include tests at high speeds or with low co-efficient of friction surfaces?

MR. GRAND: I object to this.

THE COURT: I will permit it. Go ahead.

MR. GRAND: First of all, the documents that were shown to me, your Honor, don't go to mid-June. Secondly, the documents that are the test results are the best evidence.

THE COURT: All right. Let him answer.

A No, they did not.

MR. GRAND: That was no to both, not high speeds and not low co-efficient of friction surfaces?

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THE COURT: That's right. That's the way I understood it.

Q Is Defendant's Exhibit 285 for Identification still before you, Mr. Romel?

A Yes.

Q Was Defendant's Exhibit 285 prepared pursuant to your directions?

A Yes.

MR. BENBOW: I offer it in evidence, your Honor.

THE COURT: 285?

MR. BENBOW: The first page, your Honor, is all that I am offering, as I stated before lunch.

THE COURT: All right.

VOIR DIRE EXAMINATION

BY MR. GRAND:

Q Is there any document presently in existence, Mr. Romel, which shows the actual results of the runs conducted on the dates described on the first page of 285 as opposed to the average stopping distances?

A I don't know. I couldn't answer that.

THE COURT: You don't know of any, is that it?

THE WITNESS: I don't know if they are available. I don't know where, you know --

THE COURT: They were available at some time?

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Q Should that be reflected in the first test recorded on June 1, 30 miles an hour?

A No, not necessarily.

Q At what speed on a dry surface was the valve set?

THE COURT: Oh, no.

A Both 30 and 50 miles an hour.

THE COURT: You mean to say you adjust the valve when it is moving?

THE WITNESS: No.

THE COURT: All right. What do you mean by that?

THE WITNESS: The adjustment would be a continuing trial and error method where you would adjust, take a run, re-adjust, so on.

THE COURT: Okay.

Q Any attempt to arrive at that adjustment mathematically?

A Not at that point, no.

Q In any event, after making that adjustment, the run reflected as the first run -- the only two runs, I should say, under June 1, 1965, were obtained, is that correct?

A That's correct.

Q And those runs show a difference of some four inches in the stopping distance on and off; is that correct?

A Average stopping distances, yes.

THE COURT: Those were average?

THE WITNESS: The difference in average.

MR. BENBOW: The heading so states, your Honor.

THE COURT: Okay. I haven't seen the document.

Q And you can't tell what the distance was on any single run, correct?

A Not without the original data sheets, no.

Q Now, the units that were tested, in addition to restricter valves, had transfer valves on them, did they not?

THE COURT: If you remember.

A Yes, I believe so.

Q Can you tell me what the diameter of the connecting hose was from the Perma-Vac to the manifold when it was directly connected as reflected on this exhibit?

A I think, if I remember correctly, the inside diameter of the hoses was a half inch.

Q As opposed to 3/8" used in teeing in?

A Yes, that's correct.

MR. GRAND: My objection to this document, your Honor, is that it is not the best evidence and there has been no indication or representation to the Court that the original test results showing distances, stopping distances,

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(Defendant's Exhibit D-292 was received in Evidence.)

BY MR. BENBOW:

Q Just to try to clarify this a bit, Mr. Romel, when you testified that prior to the Route 80 testing you did not do tests at high speeds or low co-efficient of friction surfaces, what were you referring to as low co-efficient of friction surfaces?

A I was referring to a condition of snow or ice. The soap test was inadequate in that it kept drying up and did not, in my opinion, represent very low co-efficient of friction surfaces.

Q And by high speeds, Mr. Romel, you meant speeds of at least 60 miles per hour?

MR. GRAND: I object to that.

THE COURT: We have already had it, Mr. Benbow. I think I covered it before.

MR. BENBOW: There seemed to be --

THE COURT: I don't have any muddle in my mind about it. Go ahead.

Are we getting now into the Route 80 tests?

MR. BENBOW: We are coming to them. Could I ask one or two other prefertory questions, your Honor?

THE COURT: Sure.

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THE COURT: All right, Mr. Benbow.

MR. BENBOW: Thank you, your Honor.

BY MR. BENBOW:

Q Did a Mr. Lundin render any assistance to you with respect to the Perma project in June of 1965?

A Yes, he did.

Q What was Mr. Lundin's position in June of 1965, if you recall?

A He was a research and development engineer at the Denville laboratory in New Jersey.

Q I show you Defendant's 467 for Identification, Mr. Romel, and ask you if you can identify that, please.

A Yes. This is a proposal from Mr. Mamberg, development manager at the Denville laboratory, the Singer Denville laboratory, to Mr. Kloby, dated June 2, 1965, in which --

MR. GRAND: I object to any further testimony.

THE COURT: Skip that part.

Q Does it relate to Mr. Lundin's services at the Elizabeth factory?

A Yes, it does.

Q Did you receive --

THE COURT: Let me get this straight.

MR. BENBOW: Sorry, sir.

THE COURT: Lundin was at the Denville Research

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& Development Center, right?

THE WITNESS: Yes.

THE COURT: Did he actually physically come up to Elizabeth?

THE WITNESS: Yes, he worked at Elizabeth.

THE COURT: All right. It wasn't clear to me before.

MR. BENBOW: Sorry, sir.

Q Did you receive a copy of Defendant's Exhibit 467 for Identification?

A Yes, I did.

Q When approximately did you receive such a copy, if you recall?

A This was shortly after the proposal was received. This is the very early part of June 1965.

MR. BENBOW: I offer Defendant's Exhibit 467 for Identification in Evidence.

MR. GRAND: Your Honor, I object to it unless it comes in --

THE COURT: I don't know what it is.

MR. GRAND: -- unless it comes in with the document to which it is in response.

It is very misleading in this form. I suggest you read it. Let's find out what the services were.

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fact that Elizabeth had the services of this fantastic man for a period of a month, and we will never find out what he didn't do.

THE COURT: Let's find out. Lundin eventually came up, right?

THE WITNESS: Yes, he did.

THE COURT: Did he work directly with you?

THE WITNESS: Yes.

THE COURT: What did he do?

THE WITNESS: Well, in addition to taking a look at the overall problems that we were experiencing with the device --

MR. GRAND: I object to this. I want very specific testimony.

THE COURT: All right. Hold on. Let's see if he can give a summary and then we will get it.

Go ahead.

THE WITNESS: -- he also provided the technical input for obtaining the oscillograph recorder, obtaining the instrumentation necessary for recording the various variables that were to be recorded.

THE COURT: What kind of instrumentation are you talking about?

THE WITNESS: These are the decelerometers,

thermocouples and the proper galvanometers to use for the testing, the pressure --

MR. GRAND: I think he is talking about road tests.

THE COURT: He is talking about the instruments that this man got for him.

THE WITNESS: -- the pressure gauges which would sense the pressure reading, and he tied all this information into the oscillograph recorder, calibrated the instrument, and helped us in installing it both in the vehicle and also on the test stands at Elizabeth.

Q So basically for this month he was working on test equipment?

THE WITNESS: He also was getting familiar with the design.

THE COURT: He would have to to get the test equipment set up, wouldn't he?

THE WITNESS: Yes. He worked with me on the problem of stopping distances. There were discussions that I had with him and subsequent to those he provided me with inputs on other means of reducing the stopping distance or controlling the free wheeling condition that I mentioned earlier.

THE COURT: When was he there?

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THE WITNESS: He was there in I think it was June, he was there some period of time in July and possibly August.

THE COURT: All right, Mr. Benbow. Go ahead.

MR. BENBOW: Is the document received, your Honor?

THE COURT: I don't think the document is necessary now. The document only states that he came up to do certain tests for a certain price.

It seems kind of incestuous that one division in Singer would charge another division a price for services, but I guess that is the way profit centers are run.

BY MR. BENBOW:

Q During June of 1965 did Mr. Lundin work full time at the Elizabeth factory on the Perma project, if you recall?

A Yes.

MR. GRAND: This is at what period of time?

THE COURT: June 1965.

Q Other than rendering assistance with respect to road testing, about which his Honor has questioned you, Mr. Romel, what if anything did Mr. Lundin do in June of 1965 with respect to the Perma project?

MR. GRAND: I think we have had it.

THE COURT: Make it June and July.

Do we have any other results of tests from these 287 tests you want to put in, Mr. Benbow?

MR. BENBOW: No, your Honor.

THE COURT: That's it.

BY MR. BENBOW:

Q During the course of the testing at Route 287 was a demonstration given to Mr. di Scipio and members of his staff?

A Yes, there was.

Q Do you recall the date or the approximate date of that demonstration?

A Around June 25, 1965.

Q Were you present during that demonstration?

A Yes, I was.

Q Who else was present that you recall?

MR. GRAND: Do we need a third version of this? Is he going to bring out something new?

THE COURT: Is this going to be merely cumulative?

MR. BENBOW: No, it isn't, your Honor. I think a question was raised as to whether the device was actually in the car when one or more of the prior witnesses testified.

THE COURT: All right. di Scipio was there?

THE WITNESS: Yes.

THE COURT: And who was that first guy?

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MR. BENBOW: Mr. Person.

THE COURT: Person, he was there, too, wasn't he?

THE WITNESS: Yes, your Honor.

THE COURT: At the time the demonstration was given, do you know if the Perma anti-skid was actually in the car?

THE WITNESS: Yes.

THE COURT: It was?

THE WITNESS: Yes, it was.

THE COURT: How do you know?

THE WITNESS: I saw it installed.

MR. GRAND: Can we be clear that it had a transfer valve on it, too?

THE COURT: All right, did it have a transfer valve on it?

THE WITNESS: Yes, it did.

THE COURT: Did it have a restricter valve also?

THE WITNESS: No, it did not.

MR. GRAND: Was it teed in or direct?

THE COURT: Do you know? Do you remember? It seems like it doesn't make much difference.

THE WITNESS: Well, tests were run at 287 both teed and direct.

THE COURT: We are talking about the time that di Scipio and Person were there?

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previously testified.

MR. GRAND: Objection.

THE COURT: If he testified about the cocking problem it's got to be a couple of days ago.

MR. BENBOW: It is.

MR. GRAND: Your Honor, the cocking problem I thought they solved with a plastic ring designed by Romel.

THE COURT: That is the best of my recollection about it.

MR. BENBOW: All right, your Honor.

THE COURT: I don't see it at this point.

MR. BENBOW: All right. I will go on.

MR. GRAND: If he wants to ask it he can ask him presumably if cocking problem continued.

THE COURT: Please. Come on. It's not a seminar.

Q What did you do after you received the Defendant's Exhibit 253 for Identification, if you recall, Mr. Romel?

A Well, I proceeded to do some testing on pressure switches at Elizabeth and assigned various people to work with me on running some experiments on various changes which I thought would improve this condition or eliminate this condition.

Q What elements of the pressure switch, if you

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recall, were redesigned after March 17, 1965?

A Well, the experiments consisted of the changing --

MR. GRAND: I don't think this is responsive.

THE COURT: Let's find out.

A The change in durometer of the O-rings.

THE COURT: Durometer, that is a word I don't know.

THE WITNESS: The durometer reading is the hardness of the rubber material. It's a measurement that you use for measuring rubber.

THE COURT: It's a reading?

THE WITNESS: It's a reading, the same thing as an inch.

THE COURT: All right.

MR. GRAND: I don't understand the answer, the experiments about the change in the durometer. That is what he said.

THE COURT: I am well aware of it. That is why I asked him to define the word durometer.

Go ahead.

A The recesses of the O-ring were changed to take up expansion and eliminate what we would call residual courses that would be built up in expansion of the O-rings.

MR. GRAND: Can we get some clarification of this,

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your Honor? I don't know what a recess in an O-ring is.

THE COURT: I know what it is. That is what counts.

A There were other experiments regarding the relative fits of the --

MR. GRAND: Did he do any of these experiments?

A -- of the other parts.

THE COURT: All right. When you talk about the recesses of the O-ring --

THE WITNESS: The recess of the shaft where the O-ring sat.

THE COURT: Do you understand it now, Mr. Grand?

MR. GRAND: I do. Can we find out if he did these tests?

THE COURT: You will have your chance.

My problem is the question started off with --

MR. GRAND: What design changes did you make.

THE COURT: -- what design changes did you make and we got a complete answer about the experiments. I would like to know what design changes were made.

What did you do different afterwards?

MR. BENBOW: You want to respond to the Court's question, Mr. Romel?

THE WITNESS: Well, some of these changes that I

1 am

VOIR DIRE EXAMINATION

BY MR. GRAND:

Q The first line that refers to a new molded body, when was that body designed?

A It was designed in '64.

Q What is it that the "new" refers to?

A The "new" refers to different sizes.

Q The size of the pressure switch was changed at some point in time?

A The size or diameter of the body.

Q I am looking at Plaintiff's Exhibit 2. Can you point to the size or diameter that you are referring to?

A The part is missing on this assembly.

Q Can you describe it for us?

A It is a plastic --

Q Is this the sleeve you were talking about, the guide sleeve?

A The guide plug, yes.

Q So the new molded body refers to the guide plug?

A Right, the new referring to the new sizes that were being tried.

Q What size was initially tried, or if you don't

remember precisely, perhaps you can tell me the difference in the two sizes. Maybe that you recall.

A Well, there were several differences. The differences in diameter are recorded in the next to the last columns.

Q We are now looking at the first page of Defendant's 262, under the column Molded Body Diameter.

A Correct.

Q Can you tell from looking at that document what the first diameter size of the plug was when it was originally designed in 1964?

A No, I cannot.

Q Do you recall whether thereafter you increased or decreased the size of that diameter?

A It was decreased, I believe.

Q Now, do the different numbers referred to in the column that we are discussing under the heading Molded Body Diameter reflect different pressure switches which were being tested or simply different plugs in one pressure switch?

A Different pressure switches.

Q How were the various diameter sizes selected?

A They were measured.

Q I don't understand that. They were measured.

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A They were turned and measured.

Q You don't mean that they were just randomly chosen?

A No, they weren't randomly chosen.

Q Was their a conscious choice to select a plug at the size point 681 and another at point 685, for example?

A Yes. We covered a range of sizes in order to determine how much clearance and what the relative fit between the mating parts should be to limit the amount of friction.

Q And do I understand you to be telling us that that was done for the first time in April 1965?

A It was done for -- no, it was done also in '64, but not to this degree. I believe in '64 the sizes were chosen and established in the initial design. Clearance was specified.

Q In 1964 was one size chosen?

A Yes.

Q And was one size tested?

A Yes.

Q And am I correct that in 1964 you did not run through a range of varying sizes in order to select that which performed the best?

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MR. BENBOW: I think we are going beyond voir dire again, your Honor.

THE COURT: Yes, I think we are getting there. Let him answer this question.

Go ahead.

A In '64 I believe more than one size was tried, yes, but I don't believe we tried the full range of tolerance differences that you are looking at now.

Q This is reflected on Defendant's 262?

A That's correct, yes.

MR. GRAND: I am going to withdraw my objection to the first page, your Honor.

THE COURT: And I am going to admit the whole thing.

MR. BENBOW: Thank you, your Honor.

(Defendant's Exhibit D-262 was received in evidence.)

BY MR. BENBOW:

Q Ifyou recall, Mr. Romel, what did you do after you reviewed the test results in Defendant's Exhibit 262?

A Two of the switches were sent to the Denville Research Laboratory for vibration and temperature analysis.

Q I note, Mr. Romel, if a copy is still before you,

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on the lower right-hand side of the first page of Defendant's Exhibit 262 there is writing which says "No. 8 and 11 sent to Denville 4/15/65."

Whose writing is that?

A That is my writing.

Q Were pressure switches numbers 8 and 11 marked or identified in any way before they were sent to Denville, if you recall?

A Yes, they were.

Q And in what fashion?

A The steel body was stamped with a numeral stamp.

Q In March or April 1965, did you request Quality Control to perform tests on the spring in the pressure switch?

A Yes, I did.

Q Did you make that request after reviewing the duPont report which I think you will recall is Defendant's Exhibit 13 for identification?

MR. GRAND: I object, your Honor. Whether he --

THE COURT: He did it, which is the most important. You did have quality control check on it?

THE WITNESS: Yes, your Honor.

Q Would you look at Defendant's Exhibit 13 for identification and tell us whether you remember whether

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AFTERNOON SESSION

(2:15 p.m.)

A L B E R T E . R O M E L , resumed.

DIRECT EXAMINATION

BY MR. BENBOW: (continued)

Q Mr. Romel, did you or persons working for you or persons working pursuant to your instruction work on the sensing unit of the Perma device in the period between December 21, 1964 and July 22, 1965?

A Yes.

Q What was the first thing you did with respect to the sensing unit after December 21, 1964, if you recall?

A Endurance testing related to the contamination problem.

Q Before we get into endurance testing, let me ask you if a Mr. George Chaplenko was employed as a Singer engineer in 1965?

A Yes, he was.

Q Where did Mr. Chaplenko work at Singer in 1965?

A In the Quality Control Laboratory.

Q At Elizabeth?

A Yes.

Q I show you Defendant's Exhibit 591B for Identification. Can you identify that document for us,

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please?

A Yes. This is a design which was submitted by Mr. Chaplenko. It is dated January 14, 1965. It is a design of a braking action governor.

Q Was it electrically operated, do you know?

A Yes, it was.

Q Was it submitted to you, Mr. Romel?

A Yes, it was.

Q In or about January 1965?

A Yes.

Q Was a prototype or test model of Mr. Chaplenko's governor built?

A Yes.

MR. BENBOW: I would like to offer Defendant's 591B for Identification in Evidence.

MR. GRAND: I would like to look at it.

THE COURT: Sure.

(Pause.)

MR. GRAND: May I have some voir dire on this, your Honor?

THE COURT: Sure, go ahead.

VOIR DIRE EXAMINATION

BY MR. GRAND:

Q I notice there is a date January 14, 1965, on the

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Q Mr. Romel, was the prototype or test model of Mr. Chaplenko's governor that was built, which you testified to a moment ago, was it built at Singer in January or February of 1965?

MR. GRAND: Can I just suggest that that question be revised to eliminate prototype and test and if a model was made, then we are just dealing with a model.

MR. BENBOW: He has already testified to that.

THE COURT: He has already testified there was one built.

Go ahead. Was it built at Singer?

THE WITNESS: Yes, it was.

THE COURT: Okay.

Q Who built the prototype or test model of Mr. Chaplenko's governor?

A Mr. Chaplenko did.

Q Do you know how he accomplished that?

A Yes. He took a Perma sensing unit --

MR. GRAND: Was he there? I object to this.

THE COURT: I am going to find out. Go ahead.

A -- and he modified it, taking out the governor and

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the governor spring and in the prototype utilized, instead of the mercury contact or bath idea here, for establishing continuity of the circuit, used a rotary-type contact ring arrangement similar to those that are used on electric generators.

Q Was this prototype tested?

A Yes, it was.

Q Who tested it?

A I tested it with several of the engineers that worked for me.

MR. BENBOW: Your Honor, is it appropriate for me to re-offer the document at this time or would you like more?

THE COURT: Not yet.

MR. BENBOW: All right, sir.

BY MR. BENBOW:

Q What were the results of these tests, Mr. Romel, if you recall?

MR. GRAND: I object to that.

THE COURT: What were the tests, first of all.

THE WITNESS: Well, the test consisted of installing the unit in a car and running a series of simulated panic stops or locked wheel conditions in which this electrical sensing unit sensed a locked wheel condition

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and relieved brake pressure by electrically controlling the solenoid which was attached to the rotary valve.

THE COURT: How long did you test it?

THE WITNESS: Approximately -- it took about three days with technical difficulties and installation and so on.

MR. GRAND: Do we have a period?

THE COURT: Yes, I am going to find out.

When were the tests run?

THE WITNESS: I think it was late January or February, early February.

THE COURT: Mr. Benbow indicated that somehow or other Mr. Perrino got involved in this.

THE WITNESS: Yes.

THE COURT: When did that happen?

MR. BENBOW: Could I?

THE COURT: Do you want to do it?

MR. BENBOW: If you don't mind, sir.

THE COURT: Sure.

BY MR. BENBOW:

Q Did you have any conversations with any Perma representatives about Mr. Chaplenko's new governor design?

A Yes.

Q With whom did you have this conversation?

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A Mr. Perrino.

Q When did you have a discussion with Mr. Perrino about Mr. Chaplenko's new governor design?

A Shortly after the test run I called him.

Q And that you previously identified as late January or early February, I believe?

A Right.

Q What did you say to Mr. Perrino about Mr. Chaplenko's design, if you recall?

A I said that Mr. Chaplenko had come up with an idea of electrically sensing wheel lockup and that we had tried it on the '64 Chevy; it appeared to operate in a manner similar to the condition he described on low co-efficient. He always said that it pumped more rapidly, and I said it looked like a good idea to pursue, and he said that he didn't think the idea was worth any merit. He said it would take years and years to perfect the device; we already had a proven device, a perfected device; we had no reason to start re-inventing a skid unit; that he didn't see any point in pursuing it.

Q Anything else that you recall?

A Not that I recall now, no.

Q At this time did you pursue Mr. Chaplenko's idea any further after your discussion with Mr. Perrino?

A No.

THE COURT: Received.

(Defendant's Exhibit 234 received in Evidence.)

BY MR. BENBOW:

Q If you recall, Mr. Romel, were endurance tests in fact continued throughout the month of January 1965?

A Yes, they were.

Q Were any problems in the sensing unit discovered as a result of endurance tests during January 1965?

A Well, it was a --

MR. GRAND: I am going to object to that question in that form.

THE COURT: Yes.

MR. GRAND: I remind the Court that the unit which was in the car in December had contamination.

THE COURT: I am aware of that. Rephrase the question.

Q What was your experience with the sensing unit in connection with your endurance testing during January of 1965?

MR. GRAND: Same objection.

THE COURT: We are talking about the Perma sensing unit as opposed to the Chaplenko sensing unit.

THE WITNESS: Yes, I understand, your Honor.

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THE COURT: Okay. Answer the question.

A Well, we continued to have problems related to the contamination. This was the reason for continuing the tests. This was work that had been started earlier, and we continued to have this problem.

MR. GRAND: Are we clear that the problem is contamination getting into the unit?

Q I show you Defendant's 236 for Identification, Mr. Romel, and ask you if you can identify that, please.

A This is a letter from me to Mr. Broeker, dated February 1st, 1965. It is a progress report on an endurance testing of a sensing unit.

MR. BENBOW: I would like to offer Defendant's 236 for Identification in Evidence.

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t2/1 pm

VOIR DIRE EXAMINATION

BY MR. GRAND:

Q The numbers referred to on the left-hand side of Defendant's 236, do those numbers refer to the same units as those described on 234?

A Yes, I believe they do.

Q Take for example Item No. 2, after which it says "Fail-replaced with No. 9," and it has an accumulated mileage of 19,556. Is that 19,000 what was accumulated on No. 2 before it failed or on No. 9 after it replaced it?

A On No. 2 at the time of failure.

THE COURT: If you look down the page, Mr. Grand, you will see that 9 has its own mileage.

MR. GRAND: I see.

Q I assume that these units continued to be run at 80 miles an hour 24 hours a day until the speed was reduced to 60 miles an hour?

A Yes.

Q Were they also run 7 days a week or were they not run on the weekends?

A We tried to run them on weekends. I am not sure whether we accomplished this objective every weekend.

Q You think some of the weekends they would be

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running and some they wouldn't be?

A Perhaps, yes, especially where there were malfunctions. As I mentioned before, if the malfunction occurred, for example, on a Friday night, the guard would just shut the unit down, it wouldn't operate until Monday morning, when we came back.

Q What would you do to a unit that had malfunctioned other than take it off the stand and replace it with another unit?

A Well, we would examine it, in some cases we would send them up to the lab.

Q But once a unit had malfunctioned and had been shut off by a guard would you start it up again, that same unit?

A No. It would be taken out of the test.

Q The document refers to each of the above units becoming highly contaminated. Was that contamination observed in December as well as February?

A Yes. It was a problem which we felt could easily be solved.

Q But it was one that was observed before December 21st?

A Yes, it was.

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MR. GRAND: I have no problem with this document, Judge.

THE COURT: Mark it in evidence.

(Defendant's Exhibit D-236 was received in evidence.)

BY MR. BENBOW:

Q Do you still have 236 before you, Mr. Romel?

A Yes.

Q Would you look again at the paragraph to which Mr. Grand directed your attention, I believe.

I would like you to note the next to the last sentence of that last paragraph of Defendant's Exhibit 236, where it is stated "It should be noted that various attempts to restrain the foreign matter have been fruitless."

Would you describe your attempts, if you recall them, prior to February 1, 1965 to prevent the entry of foreign matter into the sensing units?

A Well, there were a number of different methods employed, the use of different material, washers and gaskets, things of this nature.

Q Where did the foreign matter discussed in Defendant's Exhibit 236 come from, if you know?

A Well, it was a combination of particles which were introduced through the cable and filings or shavings

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from the drive cable face and sensing unit coupling. There were also particles that were determined by the laboratory to be internal components that were just wearing out, such as the thrust washer, and some of the other components inside the unit which was subjected to contact during rotation.

Q What did you do with respect to the sensing unit contamination, if you recall, after you prepared Defendant's Exhibit 236?

A Well, I did actually two things. We continued to try to come up with means of reducing the wear through lubrication and also tried other ideas as far as modifications in the coupling and the drive cable area.

The other thing that I did was to request from Mr. Perrino an investigation under the technical services contract to explore possibilities that the Perma people might come up with that would solve the problem.

Q Let me show you Defendant's 240 for identification, Mr. Romel, and ask you if you can identify that, please, sir.

A Yes. This is a letter from me to Mr. Perrino dated February 2, 1965. It has attachments to it which were copies of the endurance testing that was performed. The letter requests an investigation of possible design

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changes for this problem.

MR. BENBOW: I offer Defendant's 240 for identification in evidence.

VOIR DIRE EXAMINATION

BY MR. GRAND:

Q Looking at the last page of the exhibit, can you tell us who determined that the test speed of 80 miles an hour may have been excessive for continuous running?

A I did.

Q Was that after discussion with anyone?

A Possibly, yes.

Q Possibly Mr. Perriono?

A Possibly.

MR. GRAND: I have no objection to this.

THE COURT: Mark it in evidence.

(Defendant's Exhibit D-240 was received in evidence.)

xx

BY MR. BENBOW:

Q If you recall, Mr. Romel, did you receive a response to your request in Defendant's Exhibit 240 for a design change to eliminate the sensing unit problem?

A No, I don't believe I did.

Q After February 1, 1965 did you test sensing units which incorporated new design changes to eliminate

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the introduction of foreign matters in the sensing unit?

A Yes.

MR. GRAND: Are we going to get the specific design changes?

MR. BENBOW: I hope so.

MR. GRAND: Okay.

Q I show you Defendant's Exhibit 242 for identification and ask you ifyou can identify that.

A It's a letter from me to Mr. Broeker dated February 10, 1965 and is additional endurance testing of the sensing unit.

Q Did you write this document, Mr. Romel?

A Yes.

MR. BENBOW: I offer Defendant's 242 for identification in evidence.

THE COURT: You object, Mr. Grand?

MR. GRAND: I would just like to look at it, your Honor.

VOIR DIRE EXAMINATION

BY MR. GRAND:

Q You will note that in note 1 it refers to units 12, 13 and 14 as being conventional sensing units taken from the latest stock.

There are no accumulated mileages for those

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units reflected on this document, are there?

A No. 12 replaced No. 11, No. 13 replaced 3.

Q My question is are there any mileages recorded on this document that were attained with units 12, 13 or 14?

A No.

Q Unit No. 1, which reflects accumulated mileage of over 79,000, is the same unit No. 1 that is referred to in Defendant's 236 and I believe it was 234, is that correct?

A Yes, I believe so.

Q Was unit No. 1 also a conventional sensing unit taken from the latest stock?

A We have a problem with that. That one was attached differently on the test stand.

Q What do you mean?

A The unit was directly connected to a gear box without the flexible shaft. It says "See Note No. 1."

The reason --

Q Is that true of unit No. 1 throughout the testing.

A Yes.

Q It was always attached directly to a gear box and not a flexible cable?

A That's correct.

Q Unit No. 3 as of February 10, 1965 has accumulated mileage of some 69,000. Was that a conventional

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sensing unit taken from the latest stock and hooked up to a flexible shaft?

MR. BENBOW: Your Honor, we seem again to be getting beyond voir dire, sir.

THE COURT: I will permit it.

A I don't know. I can't answer that.

Q There is nothing on the documents that indicates it was not hooked up with a flexible shaft?

A No, I wasn't referring to that part of your question. The other units were connected with a flexible cale. I was referring to whether or not it was a unit that had not been modified.

Q Do not notes 2, 3 and 4 on Defendant's 242 tell you precisely which units had been modified and how?

A Yes, but it doesn't refer to No. 3, which was your question.

Q Perhaps we can do it another way. Were any of the units described in either Defendant's 234 or 236 modified units, that is, containing design changes made by you or your subordinates in 1965?

A Yes. I believe all of them had some type of modification in them except the first one, which was run directly from a gear box.

The reason for doing that was to determine what

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influence the flexible cable had on the unit.

Q Can you tell us what modifications there were on these various sensing units that are described in those exhibits before we get to this one, that is, 242?

MR. BENBOW: Your Honor, again, we seem in the area of cross.

A I can't do that with this document, no, and I can't remember them specifically at this time.

Q But it is your best recollection that the units on Defendant's 234 and 236 contained some design modifications?

A Yes, with the exception of No. 1.

Q Of No. 1?

A Yes.

Q Are the design modifications that those units contained one or more of the same design modifications reflected in notes 2, 3 and 4 on Defendant's 242?

A No, I don't believe so, because prior to these tests we did not --

Q By "these tests" you mean those on Defendant's 242?

A Yes.

Q Go ahead.

A We did not insert any of the other restraining

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materials into the sensing unit coupling insert.

Q Can you tell us what design changes were incorporated -- I don't mean specifically; by that I don't mean try and tell us what specific change was in a specific unit -- but can you tell us generally what kinds of modifications were made to the sensing units on which endurance tests were run as reflected in Defendant's 234 and 236?

MR. BENBOW: Your Honor, he has already testified to this, in addition to the fact that it seems to me that it goes --

THE COURT: I haven't heard the testimony.

MR. BENBOW: When we introduced 234.

MR. GRAND: Nobody told us about any modifications to them, and that is why I was surprised to find it on the voir dire of 242.

THE COURT: Do you know what the question is?

THE WITNESS: Yes.

THE COURT: Go ahead;answer it.

A In general terms, the prior modifications consisted of different type of material washers which were inserted and did not have steel inserts.

Q Maybe you can explain the difference to me because I just don't understand the term. Is a washer with

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a steel insert some sort of a reinforced washer?

A Yes, because I think by this time we had recognized that there was a definite wear problem.

Q Can you tell me where --

A As opposed to the previous situation, it was more of a -- sort of more as utilizing a gasket to prevent entry of particles, in that sense. So the design was changed accordingly.

MR. BENBOW: Your Honor, this line of questioning, it seems to me, might be quite appropriate for cross, but I don't understand how it keeps coming in on voir dire. We are back to other documents, not the documents that are being offered.

MR. GRAND: These documents --

MR. BENBOW: Not the document that is presently being offered, sir.

THE COURT: All right.

MR. GRAND: I think two more questions will do it.

THE COURT: I would think you could even do it in less than that, but I will let you ask the two.

Q Can you tell me where on the device the washers that you have just described, that existed on the units tested in Defendant's 234 and 236, were placed on the sensing

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unit or on the attachments to the sensing unit?

A They were placed between the face of the flexible drive shaft coupling and the face of the sensing unit coupling.

Q Were there modifications to any of the units on Defendant's 242 other than those specifically described in the notes?

A I don't believe so.

Q I should modify my question to say except to the extent that one of those units may have been one of the units in Defendant's 234 or 236.

Do you see what I am getting at?

A Yes.

Q In other words, if there was an unreinforced washer on let's say unit No. 3, it would have continued on unit No. 3 when it was tested as reflected in Defendant's 242?

A That's correct.

MR. GRAND: I have no objection.

THE COURT: All right.

Mark it in evidence.

MR. BENBOW: Would it be appropriate to have a short recess, your Honor?

THE COURT: Sure, take ten.

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MR. BENBOW: Yes.

Q I think you misunderstood me, Mr. Romel. I wanted to direct your attention to the third page, and thereafter, headed, "Fail-Safe Design Deficiencies of the Perma Anti-Skid Device", and identify that for us, please.

A This is a fail-safe analysis which I performed. It is dated August 25, 1965.

Q Mr. Romel, had you performed an analysis of fail-safe design deficiencies of the Perma device prior to your writing this document on August 25, 1965?

MR. GRAND: Do you mean other than --

THE COURT: He had to do it before he wrote the document. All right? You mean at some time prior to the time he composed it?

THE WITNESS: This is actually the second analysis which was made. The first one did not include the next to the last column which was the effect of design changes on the inventories. There was a prior analysis.

THE COURT: When did you do that?

THE WITNESS: It was early August, I believe, mid-August.

THE COURT: Okay.

MR. GRAND: The first one was mid-August?

THE COURT: Yes.

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THE WITNESS: I don't recall. It was right after vacation, I think.

Q At whose request was the prior analysis undertaken?

A Mr. Person.

Q At whose request did you perform the fail-safe analysis which is contained in Plaintiff's Exhibit 94?

MR. GRAND: I object to that. I mean, we are trying to create two different ones. We have got the same one with an added column. It is not a different analysis.

THE COURT: It doesn't matter. Whose request?

THE WITNESS: Mr. Person.

Q Did you receive any instructions from Mr. Person after you completed the fail-safe analysis in Plaintiff's Exhibit 94?

A Yes.

Q What were your instructions?

A I was instructed to conduct a two-phase program aimed at developing solutions to the fail-safe problem. The first phase was to be directed within the Perma design concepts and within the patents as best as I could.

The second phase was to start developing ideas and projects that would be of a longer range. These were to be solutions which would drastically depart from the Perma concepts.

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BY MR. GRAND:

Q Can you tell me if the redesigned vacuum container was designed for inclusion with a unit containing a transfer valve or with some other unit?

A It was without a transfer valve.

MR. GRAND: All right.

THE COURT: All right, Mr. Clerk, mark it in evidence, will you.

(Defendant's Exhibit D-670 received in evidence.)

BY MR. BENBOW:

Q What was the larger Perma-Vac can designed to do, Mr. Romel?

A It was designed to increase the supportable pressure, allow sufficient force developed by the vacuum input to obtain the displacement required, and to eliminate the need for a vacuum assist or transfer valve. It would also provide enough supportable pressure and eliminate the problem of vacuum failure resulting in reduced output pressure.

Q Did it have anything to do with the lagging problem?

A Yes. The additional displacement and the higher or larger projected area was to allow the unit to operate

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with lower vacuum delivery from the engine.

Q Was the larger Perma-Vac can designed to address itself to a fail-safety problem, and if so, what was that problem?

A Yes. It was addressed to eliminate the problem of loss of vacuum and resulting reduction in brake line pressure, and also the problem of lagging.

Q Were larger Perma-Vacs built to these specifications?

A Yes.

Q Were they tested?

A Yes.

Q Were they tested on automobiles?

A Yes.

MR. GRAND: Can we get a number other than "they"?

Q What were the results of the tests on the larger Perma-Vac cans?

THE COURT: Do you have a document?

MR. BENBOW: Not at this time, your Honor, I don't think.

THE COURT: All right.

A The results of the tests indicated that the unit was too sluggish or the pulse rate was affected. The problem that this relates to is the basic configuration of

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off on a Delrin seat or bushing.

He also said he had a third modification which was what he termed a fail-safe and fail-safe, which he said you really don't need, but it could be applied to shut off the system, again from a pre-determined time of sensing vacuum into the rear chamber would activate the solenoid.

THE COURT: What did you say to him, if you recall?

THE WITNESS: Well, I asked questions as we went along and made a sketch of what he was talking about, the best I could, from what he told me.

He also invited me to come up to Attleboro to see some parts that he said he was altering and making up there, and I told him to get in touch with Mr. Person and also that I would like to see some schematic drawings on it. That's about all I recall of that conversation.

THE COURT: Before we leave that, Mr. Reporter, would you be good enough to read back the description of the change in the piston?

(Record read.)

THE COURT: Now, I asked to have that portion read back to you -- and I want you to think about it again to make sure that is what he said to you -- not the exact words, but to the best of your recollection.

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MR. BENBOW: Your Honor, he did say he worked on it and he identified others who worked on it.

THE COURT: I understand that, but the problem is he has already testified that he had certain designs which were theoretically possible. I don't know what this is going to add to it, unless perhaps you are going to end up with two different answers to basically the same question.

MR. BENBOW: I think this should clarify it, your Honor.

THE COURT: Go ahead, answer it, if you know.

THE WITNESS: No, I don't --

Q Were you able to design a workable hydraulic bypass feature?

A No.

MR. GRAND: Do we even have him trying to do that?

MR. BENBOW: Yes, we have him trying to do it.

MR. GRAND: They never put it into hardware.

Q Would you explain the basis for your no answer, Mr. Romel?

A I said no.

Q I know. Would you tell us the basis for that answer.

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A Well, the difficulty was in the cycling -- in timing the device with the cycle of the unit. For example, the length of time on most runs from time of brake release to re-applied brake condition was in excess of .13 seconds, which meant if you switched the valve in sooner than that you would prevent the unit from operating at all and if you exceeded it, the length of time became exhorbitant on high speeds in terms of loss of stopping distances. So it really wasn't a practical solution to this problem at all.

Q Did you have any discussions with Mr. Perrino concerning hydraulic bypass valves?

A Yes, I told him about what we were doing.

THE COURT: When was this?

THE WITNESS: Probably in December '65.

Q What did you say to Mr. Perrino on the subject of hydraulic bypass valves?

A Well, I said that we had been trying to come up with a device that would bypass the unit but were having trouble with the timing of the device.

THE COURT: This is in December, right?

THE WITNESS: Yes. It could have been January. I am really not sure. It's around that period of time.

THE COURT: All right.

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Q Subsequent to your trip to Kelsey-Hayes on November 30, 1965, did you make another trip to Kelsey-Hayes?

A Yes.

Q When did you make this trip?

A This was in February 1966, I think.

Q Who, if anyone, from the Singer Company went with you?

A Mr. Person.

Q And what did you do at Kelsey-Hayes in February 1966?

A I met with Mr. Every and reviewed with him the test results on the tests that they had conducted on the Perma anti-skid device.

THE COURT: By the way, just to prove there are times I do reverse myself, mark 534 in evidence.

MR. BENBOW: Thank you, your Honor.

THE COURT: Read it again before you thank me.

MR. BENBOW: I have read it many times, your Honor.

(Defendant's Exhibit D-534 received in evidence.)

Q Was Mr. Every the project engineer?

A Yes.

Q I show you Defendant's 335 for identification and ask you to identify it, please.

A This is a memorandum from Mr. Person to Messrs. Boriss, Broeker and Elman, dated February 15, 1966, concerning the visit to Kelsey-Hayes.

Q With a copy to you, Mr. Romel, on the right?

A Yes.

Q Go ahead, sir.

A That was the first page. The second page is a memorandum from Mr. Every to Mr. Meyer, dated February 3rd, 1966, and is his evaluation of the Perma anti-skid

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device.

The following pages are his report. The last or the fourth page is the schematic diagram which Mr. Every drew of the Perma installation.

The fifth and remaining pages are a transcription of Mr. Every's memorandum to Mr. Meyer

THE COURT: I'm sorry, I don't understand that. What do you mean by that?

MR. GRAND: It's illegible, your Honor, so it's been retyped.

MR. BENBOW: I believe that constitutes a transcription of the second and third pages not, of course, including the schematic diagram, your Honor, which is the fourth page.

THE COURT: Let me see it.

I assume you are going to offer it at this point, right.

MR. BENBOW: Not quite at this point, your Honor.

THE COURT: Okay.

Q Did you receive a copy of Defendant's Exhibit 335 for identification?

A Yes.

Q I assume that the copy you received did not include the transcription in the last pages?

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A That's correct.

MR. BENBOW: I offer it in evidence, your Honor.

MR. GRAND: Objection. It was offered and rejected on April 18th.

MR. BENBOW: Your Honor, ever so briefly, I think it should be admissible, among other reasons, as a business record of a non-party.

THE COURT: If that is the grounds for its admission --

MR. BENBOW: One ground, your Honor.

THE COURT: One ground? All right. I will sustain the objection,

Q Mr. Romel, did there come a time in 1966 when the Ford Motor Company made a technical evaluation of the Perma device?

A Yes.

Q In connection with Ford's evaluation of the device, did you receive any instructions from anyone?

A Yes.

Q When did you receive such instructions, approximately, Mr. Romel, or to the best of your recollection?

A I think it was late February '66 or early March.

Q From whom did you receive such instructions?

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A I don't remember. It was either Mr. Person or Mr. Kloby. I don't really recall which one right now.

Q Do you recall receiving telephone instructions from Mr. Person?

MR. GRAND: I object. He has just said he didn't.

MR. BENBOW: I am trying to refresh his recollection, your Honor.

THE COURT: I will permit it. Go ahead.

A I remember having discussions with him regarding a trip and evaluation to the Ford Motor Company which was set up through Mr. Person, yes.

THE COURT: When was this? This was late February, early March?

THE WITNESS: Yes.

Q Do you recall anything else that Mr. Person instructed you to do?

MR. GRAND: I object to the form.

THE COURT: No, I will permit it.

MR. BENBOW: In this regard obviously.

A Well, he instructed me to obtain the anti-skid components and the necessary variable kit for adaptation to a Ford product and to make a trip to Ford for the purpose of having them evaluate the device, and instructing

me to answer any questions that the Ford engineers might have or assist them in any way that I could.

THE COURT: How many devices did you bring out?

THE WITNESS: I don't remember whether it was more than one.

THE COURT: You don't remember whether it was more than one. Did you bring any plans and specs?

THE WITNESS: No, just the units.

THE COURT: All right.

Q Would you respond to my question, Mr. Romel, if you recall it. It is would you describe the type of testing which you witnessed at the Ford Motor Company on March 7, 1966.

A The test consisted of low speed stability tests

and stopping distance tests on painted soap strips. There were also stopping distance tests at I believe 40 miles an hour on dry pavement and also on wet pavement. The wet pavement tests, as I recall, were discontinued because of a malfunction in the oscillograph recording equipment.

Q Do you recall --

A The testing was conducted with the driver in a hands-off condition, in other words, hands off the wheels, no driver correction was introduced during the testing.

MR. GRAND: Your Honor, I object to that unless it is established that he was in the car with him and could observe that.

THE COURT: I will permit it. Go ahead. Anything else you remember about the test?

Q Did you request that several runs under each condition be tried without the restrictor valve, Mr. Romel?

A Yes.

Q Would you describe what happened during the tests which you witnessed at the Ford Motor Company on March 7, 1966?

A On the painted soap strips the vehicle veered

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off of the strips.

MR. GRAND: Can we get some clarification as to whether this is with or without the restrictor valve?

THE COURT: We will get to it. Just relax.

A The dry pavement and the wet tests indicated that --

MR. GRAND: I object.

THE COURT: What did you see?

A Well, both with and without the unit the vehicle came to rest in approximately the same angle or yaw.

THE COURT: Are these tests both with and without the restrictor valve?

THE WITNESS: No.

MR. BENBOW: You mean the dry asphalt test, your Honor?

THE WITNESS: No. During this visit I believe all of the tests were conducted with the restrictor valve.

When the tests were continued due to the malfunction of the oscillograph, during my discussions we agreed that there would be further testing done with and without.

THE COURT: All right.

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THE WITNESS: There was also testing done on rear wheels only on this test.

Q On or about March 15, 1966 did you transmit Defendant's Exhibit 336 for identification to Mr. Person?

A Yes.

Q Was this written as the supervisory engineer of the Central Engineering Staff of the Consumer Products Division?

A Yes.

Q Was it written in your capacity as an engineer?

A Yes, it was.

Q Was it written in the course of your regular duties in preparing a trip report on a trip of this kind?

A Yes.

MR. BENBOW: Like the previous document that I offered, your Honor, this document, it seems to me, is a document prepared in the ordinary course of Mr. Romel's duties as an engineer with the Singer Company and is an ordinary business record of the Singer Company, and I would like to offer it.

MR. GRAND: Your Honor, in view of the fact that the testimony came in to complete it, I am going to withdraw my objection to the document.

THE COURT: You want it in?

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MR. GRAND: Absolutely.

MR. BENBOW: That goes for the prior document, too, I assume.

THE COURT: No, I don't believe it does.

MR. BENBOW: The prior document, of course, is 335.

I misspoke. The prior document was 559 for identification.

(Defendant's Exhibit D-336 was received in evidence.)

BY MR. BENBOW:

Q Mr. Romel, let me show you Defendant's 337 for identification and ask you to identify that, if you would, please.

A This is the Ford Motor Company test report of the Perma anti-skid device. It was signed by Mr. Hallahan to Mr. A. E. Samson, dated March 23, 1966.

Q Subsequent to your trip to the Ford Motor Company, did you receive a copy of this report from Ford regarding their evaluation of the device?

A Yes.

Q From did you receive a copy, if you recall? Was it someone in the Singer organization, Mr. Romel?

A Yes. I believe it was Mr. Person.

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MR. BENBOW: I offer Defendant's Exhibit 337 for identification in evidence.

MR. GRAND: Objection.

THE COURT: Sustained.

MR. BENBOW: Your Honor, do you wish to take a morning recess? I think I am going to a new subject at this point.

THE COURT: All right, fine. Take ten.

(Recess.)

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MR. BENBOW: Prior to the recess, your Honor, you apparently excluded one or more of my offered exhibits on the grounds that they might have been in contemplation of litigation.

I would like to return to Defendant's Exhibit 335, which clearly was not prepared in contemplation of litigation, that part of it which was prepared by the Kelsey-Hayes Company on Kelsey-Hayes letterhead. They are not a party to this litigation and never any contemplation that they would be, and it seems to me the document on its face is a document which was prepared in the ordinary course of their business and ought to be accepted into this record at this time.

I think it would be burdensome and unnecessary to require the Kelsey-Hayes witness to come here -- since we are trying to expedite this trial -- solely for the purpose of identifying this document as a document kept in the ordinary course of business by Kelsey-Hayes. Therefore, I would like to vigorously argue that we ought to receive this document in evidence at this time so that the complete picture of what was done and what Singer received at that time is in the record, your Honor.

MR. GRAND: Do you want to hear a response?

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THE COURT: Sure, go ahead, let's hear you.

MR. GRAND: There are numerous objections to this document, only one of which was that it was prepared in contemplation of litigation.

It is, of course, replete with hearsay, represents tests conducted by a third party, and if it comes in on some interesting business records theory, which has not been substantiated, it would still not satisfy the hearsay objections, it would not provide us with a witness to cross-examine.

Moreover, because of the facts in the record which preceded the submission of any unit to Kelsey-Hayes for testing, the whole subject is completely irrelevant to the issues in this litigation.

MR. BENBOW: Your Honor, Mr. Grand's objection, clearly grounded largely, apparently, on hearsay, ignores the fact that I am offering in part as a business record, a recognized exception to the hearsay rule.

MR. GRAND: No.

THE COURT: Well, my ruling remains the same.

your Honor.

Q Do you know, sir, the source of the answers that appeared on the documents that were present when you met with Winthrop, Stimson?

MR. BENBOW: Objection.

THE COURT: Objection.

THE COURT: I will sustain that objection. It is too close.

MR. GRAND: I have no concern with the substance of the conversation.

THE COURT: I understand that.

MR. GRAND: All right.

THE COURT: I have a problem. You are trying to prove two things in this entire exercise. I know what you are trying to prove. I suggest you go on to something else.

Q Mr. Romel, you have testified about graduating from the Newark College of Engineering?

A Yes.

Q That was, if I recall, some time in June of 1964 that you graduated?

A Yes, that's correct.

Q Prior to graduating you applied, did you not, for licensing by the New Jersey Board of Professional

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engineers?

A Yes.

Q That licensing procedure involves a two-part examination, among other things, does it not?

A Yes. I think it is three.

Q Can you tell me what the three parts are?

A The first two are written exams, as far as I could remember, and the third I believe is an oral examination in front of a review board or something of that nature.

Q Do the first two portions test basic engineering or knowledge or basic engineering sciences?

MR. BENDOW: Objection.

THE COURT: I will sustain it. I don't know what that has to do with it.

Q Did you take such an exam?

A Yes.

Q When did you take it?

A Probably July. It was right after the closing of the school for the summer.

Q You did not pass that exam, did you?

A No, I did not.

Q Did you ever apply to take the exam again?

A No.

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Q You were eligible to do so, were you not?

A Yes.

Q I want to review to some extent your job experience at the Singer Company.

Your first job with the Singer Company was as a parts inspector?

A Yes, that's correct.

Q Were you examining or inspecting parts as they came off an assembly line?

A Off production machinery.

Q And thereafter you became an apprentice patternmaker?

A Yes.

Q Did you ever complete your apprenticeship in patternmaking?

A All but the last three drawings. I started going to Newark College of Engineering.

Q During the period 1956 to 1959 you testified at page 4094 that initially you did the detail work on parts drawings for machine designs and you soon became a machine designer yourself. Do you recall that in, substance?

A Yes.

Q Were you throughout that period a draftsman?

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other place during the years '63 to '66?

MR. BENBOW: Objection.

THE COURT: I don't see the relevance.

MR. GRAND: I thought there was some testimony about that. That is the only reason I wanted to make it clear.

Q That doesn't seem to you to be a fact.

A Well, Denville was created from the product development group that was at Elizabeth, but I don't remember when this happened. They moved out to Denville.

Q Do you have any recollection of when that happened?

A No. It is quite a while back.

Q Some time prior to any involvement by Singer with the Perma project?

A Yes, I think it was before.

Q So we are clear, you were never assigned to work in that facility, is that correct?

A At Denville.

Q Yes.

A No.

Q Prior to the Perma project I gather you also had never been employed by an automotive company.

A No.

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Q Nor had you been employed by a company engaged in the manufacture of brakes or brake devices?

A No.

Q Am I also correct that prior to involvement with Perma you had not worked on braking systems?

A That's correct.

Q Prior to your experience with the Perma project had you had any experience with making or attempting to make devices fail-safe?

A Well, I worked on safety devices for production equipment.

Q You don't equate the two terms, do you, fail-safety and safety?

A I think safety in my opinion can be equated to fail-safe, yes.

Q What were some of the safety devices you worked on at Singer prior to your involvement with Perma?

A These generally took the form of devices for shutting off equipment when an operator's hands were in the work area.

THE COURT: Are you talking about photo-electric cells, something like that?

THE WITNESS: Sometimes, yes.

Q My question is, did you ever prior to in-

Q In September, 1964 you became the manager of contract engineering, didn't you, for Singer?

A Yes, that's correct.

Q And as such you were in charge of some 10 to 15 projects, only one of which was the Perma project?

A That's correct.

Q And am I correct that prior to December, 1964 only a limited amount of your time was spent on the Perma project?

A No, that's not correct.

Q What percentage of your time between June and December, 1964 was devoted to Perma?

A I would say most of my time.

Q The other 10 to 15 projects required only a little bit of your time, is that what you are saying?

A Yes, that's what I am saying.

MR. BENBOW: Off the record, your Honor. Could I possibly --

THE COURT: You want to go off the record? Sure.

MR. BENBOW: Just for one question to you.

(Discussion off the record.)

Q Do you recall, sir, testifying that Mr. Perrino told you that the Perma anti-skid device was under evalua-

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I assume Mr. Kloby is going to appear at some point.

MR. GRAND: I assume that is some kind of a promise, if the only objection is timing.

Q At some point in the Spring of 1964 you reviewed blueprint specifications, did you not?

A Yes.

Q And you concluded that those specifications were generally unclear?

A There were some cases where there were no specifications at all.

Q And where there were specifications, am I correct that you concluded that some of those were unclear?

MR. BENBOW: May I have a page number on this?

THE COURT: Do you have a page number on it?

MR. GRAND: I wasn't asking him what he testified about, but he might try 1548.

MR. BENBOW: It seems to me he was.

A There were cases that needed clarification, yes.

Q Is it true that generally the specifications were very unclear?

Let me ask you, Mr. Romel, Page 1548: "Answer: Generally the specifications were very unclear." And then it goes on.

There is no question about that, is there?

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THE COURT: There is no question about what?

MR. GRAND: That is what he concluded when he reviewed the blueprint specifications in the Spring of 1964.

THE COURT: Is that what you concluded?

THE WITNESS: Well, I don't think, you know, it wasn't the total review of all of the drawings at one specific time where you reach some sort of conclusion. You had a problem with the drawing; you got a hold of Mainelli or somebody and got an answer or tried to get an answer on what the question was at that particular time.

Q You did not review the drawings at one time?

A I don't think it really happened that way.

Q Page 1547, sir, do you recall testifying as follows:

"Q. Subsequent to this conversation, what, if anything, did you commence to do with regard to the Perma project?

"A. Well, I was supervising several engineers who were assigned to develop the operation sheets, install the equipment and start the initial phase of manufacturing and assembling. I also reviewed the blueprint specifications and in this regard there was quite a bit of confusion in that regard."

A Yes.

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MR. BENBOW: I think the statement read, "manufacturing or assembling." I think Mr. Grand read "and."

THE COURT: "Or." All right.

Q You did review the blueprint specifications?

A Yes.

Q Were there several drawings that specified the same component, that is, different items to fill the same components?

A Yes.

Q For example, there were four different filters specified, were there not?

A Yes, that's correct.

Q And generally, you concluded that these specifications were fairly unclear, did you not?

A In general there were a lot of unanswered questions that needed clarification.

Q So you invited Mr. Mainelli to come down, to help clarify this matter?

A Yes, I believe so.

Q And did you also send Mr. Wagner of Singer to Perma to develop specifications, obtain additional information with respect to specifications?

A To obtain additional information.

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Q You needed information to do testing of components of the Perma device?

A Yes.

Q Was the information that Wagner got complete?

A Well, in that regard I could say that the information he received was changed several times. I can't recall right now -- the values changed on the test specs.

Q It was also incomplete as well as changed from time to time, wasn't it?

A Yes, there was information that he did not get, that we eventually got nailed down and put into a specification.

Q So that finally you got specifications which were not clear and you sent Mr. Wagner up to Perma to get additional information and that which he came back with was incomplete, is that correct?

MR. BENBOW: Objection.

THE COURT. I think he has testified already, Mr. Grand.

THE WITNESS: Could we take a break?

THE COURT: Yes. We will take ten minutes.

(Recess.)

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BY MR. GRAND:

Q In order to test the components it was necessary, was it not, to obtain testing specifications from Perma?

A Yes.

Q And am I correct that you sent Mr. Wagner up to Perma for that purpose?

A Yes.

Q And the test specifications that he came back to Singer with were incomplete in some respects, were they not?

A Yes. Some of the values had not been established.

Q Had not been established by whom?

A Perma.

Q That is, values necessary to test certain of the components?

A Yes.

Q Specifically, that's true, is it not, about the sensing unit?

MR. BENDOW: Not very specific, your Honor.

THE COURT: You are talking about June, is that correct?

MR. GRAND: Yes, your Honor.

THE COURT: Okay. Go ahead and answer it.

sure now whether it was a discrepancy or --

Q A discrepancy between what and what?

A I don't remember.

Q When you say discrepancy, do you mean perhaps a difference between two drawings that were submitted to you?

A Could have been. I don't really recall right now.

Q That would not be an instance where you were not supplied with a drawing, then, would it?

A I really don't recall.

Q Now, do I understand your testimony from direct to be that during the period from sometime prior to the June contract to about December 1964, Mr. Perrino visited Elizabethport on the average of two or three times a week?

A He was there quite frequently, yes.

Q And did you see him there on those occasions?

A Sometimes.

Q Did you talk to him on those occasions?

A Yes.

Q Did you talk with him about the device on those occasions?

A Yes.

Q You had been present, had you not, at a meeting in

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April when Mr. Perrino discussed the operation of the device and explained it to you?

A Yes.

Q And at that meeting the components of the device were spread out all over the table, were they not?

A Yes.

Q And the function of each was explained part by part? Is that true?

A I'm not too sure about that.

Q Let me read you something and see if it refreshes your recollection. This appears to be a question by Mr. Benbow at Page 4129:

"Mr. Perrino has testified about the meeting where all the parts were spread out on the table and he went through each one of them with the Singer personnel. I gathered that this also occurred at the meeting about which you have testified.

"A. That's the meeting, right."

Does that refresh your recollection as to whether each of the parts was gone through piece by piece and explained at that meeting?

A I don't recall if it was done in that manner. I recall the meeting. I recall the parts, and I recall the discussions that I had with Frank Perrino. I don't

recall how detailed the part by part --

Q You recall that that is the meeting that you testified you attended for about an hour?

A Yes.

Q And it was your understanding that the meeting lasted all day?

A Yes, I think they were there all day.

Q Now, at the part of the meeting you were present at, did you ask Mr. Perrino any questions about the device as he explained it?

A I am sure I must have, but I don't recall exactly.

Q Thereafter, on the occasion of Mr. Perrino's trips to Elizabethport, when you would see him, did you ask him questions about the functioning of various parts and components of the device?

MR. BENBOW: Objection. No time specified.

THE COURT: I understand. Hopefully we will get into it the back way.

Did you?

THE WITNESS: Yes.

THE COURT: All right. When did it happen?

MR. GRAND: I don't really need to do it that way, Judge, because I am not looking for specifics.

THE COURT: Okay.

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Q Without an answer by Mr. Perrino or an identification by Mr. Perrino of the critical areas of the device you were unable to construct such a test stand, is that correct?

MR. BENBOW: Objection.

A Well, that's not --

THE COURT: It doesn't much matter. The fact is he did not build a test stand.

Isn't that true?

THE WITNESS: Yes, that's true.

Q Am I correct that as of September, 1964 the confidence level with respect to the unit had not been determined to be satisfactory?

A What do you mean by that?

Q Let me do it another way.

You say in Plaintiff's 39, in the last sentence: "You strongly recommend that the legal aspects of responsibility be thoroughly investigated so that we may be fully covered for units sold before the confidence level is determined to be satisfactory."

What did you mean by the confidence level?

A Well, I still must refer back to the situation which caused me to write this memorandum, and that's basically the detecting of cam gear hangup, which there was

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no specification for.

Q And that led you to be concerned that there might be other malfunctions --

MR. BENBOW: He hasn't finished his answer.

THE COURT: Let him finish.

Were you aware that there could be other malfunctions.

THE WITNESS: No,I wasn't aware that there could be. I suspected theremight be.

THE COURT: All right.

Q Based on what you had learned about the cam gear and what you suspected about other parts of the device you were not confident in the marketability of the unit as it existed in September, '64, were you?

MR. BENBOW: Objection.

THE COURT: No, I will permit it. Go ahead.

A I don't think I was concerned about the marketability. I was concerned about insuring that adequate testimony was provided --

Q For what purpose?

A -- before the product left the factory.

Q Adequate testing to determine what?

A To insure that the product left the factory in

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Q So that as of September 17th you understood that Mr. Perrino was involved in designing components of the unit that violated several basic engineering principles?

MR. BENBOW: Objection.

THE COURT: He had to be aware of it. That is obvious.

I gather that everybody now has their lunch. See you back here at quarter past 1.

(Luncheon recess.)

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Q I want to talk about the tests or your experience in the car equipped with the device prior to the December contract.

You may recall that at Page 4236, in response to a question by the Court, asking when those tests or that test was performed, and the Court asking you: "After December 21st"? And you, the witness, said, "No, it was just before, I think."

Can you tell me, sir, how you fixed the date?

MR. BENBOW: What was the page, Mr. Grand?

MR. GRAND: 4236.

A The time period is related to the Perma-Vac pressure output and the experiences we were having in obtaining sufficient quantities of units to pass this test.

Q And can you fix a precise time for that?

A Yes, it was in December sometime, early December or possibly late November. I don't know which.

Q I may be under a misimpression. When you said to the Court, "No, it was just before December 21," did you mean just within a couple of days before or anytime within a month or two before?

MR. BENBOW: Incorrect quote, your Honor.

THE COURT: I think, Mr. Grand, he has indicated

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that it was in November or early December.

MR. GRAND: That is not what he indicated on direct.

THE COURT: I understand.

Q What I want to know is when these tests occurred.

A I can't nail it down specifically to a date, but it was around that period of time.

Q Around which period?

A Late November or early December, somewhere around there.

Q It was in late November, wasn't it?

A Could have been.

Q Do you consider late NOvember 1964 to be just before December 21?

MR. BENBOW: Objection.

THE COURT: Oh, you can answer it. Go ahead.

A Well, I was thinking, you know, prior to.

Q You understand that December 21 is a significant date in this case, do you not?

A Yes, I know that.

MR. BENBOW: Objection.

THE COURT: All right.

Q Have a look at Defendant's -- this was at one time a Plaintiff's proposed Exhibit 227 not numbered for

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this trial. It should be numbered 147, Plaintiff's 147.

MR .GRAND: Before you go on, I would like to have it marked Plaintiff's Exhibit for identification in this trial, 147.

(Plaintiff's Exhibit 147 marked for identification.)

Q Does the exhibit now marked Plaintiff's 147 which is entitled, The Singer Company Experimental and Test Data Sheet contain the results of the tests at which you were present of a vehicle equipped with the device sometime prior to December 21, 1964?

A Yes, this is the hydraulic pressure test.

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Q Does this document reflect the tests that you have testified that you were present at and participated in, at least to the extent of being present in the automobile when the pressure tests were conducted?

A Yes, I believe this is.

Q Can you tell me who prepared that?

A Walter Kalinowski.

Q Did he participate in those tests as well?

A Yes.

Q Was he the driver?

A No, I don't believe he was.

Q Who was the driver?

A I think Sharp was there and myself.

MR. GRAND: I will offer Plaintiff's 147.

MR. BENBOW: Can we look at it?

THE COURT: Sure. Do you object to it, Mr. Benbow?

MR. BENBOW: No.

THE COURT: Mark it.

(Plaintiff's Exhibit 147 was received in evidence.)

Q Does the date in the upper left-hand corner of that document, which is 11-30-64, refresh your recollection as to the date on which the tests were

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conducted?

MR. BENBOW: Objection, your Honor. It suggests that there was only one date on which such tests were conducted.

THE COURT: Were tests conducted on November 30, 1964?

THE WITNESS: Yes, I would say so.

Q Were there pressure tests utilizing a vehicle conducted on other days than November 30 prior to December 21?

A No, I don't believe so. I think there was only one instance.

Q Can you tell me how the car was instrumented? What kind of gauges did it have on it, if any?

A It had pressure gauges.

Q What kind of car was it?

A A '62 Chevy.

Q Is this the station wagon?

A I thought it was.

Q Is there something in that document that suggests to you it was some other car?

A Well, there might have been two different Chevy cars. I don't know. This says conventional shift and I don't recall conventional shifting on the

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Chevrolet. But that was a '64, I guess.

Q The '64 Chevrolet is the station wagon, is that what you are talking about?

A Yes, I think so.

Q The car that was tested with the pressure gauges with you present in the car, was that a car with a conventional shift or was that some other car?

A I don't remember now.

Q Can you tell me what pressures the gauges were intended to measure?

A The pressure output of the Perma-Vac.

Q Any other pressures?

A No.

Q Were there any gauges that were attached to measure pressures in the hydraulic lines?

A Well, that's the same thing.

Q I'm sorry. What does that gauge measure?

A It measures the hydraulic pressure in the brake line upon activation of the unit.

Q It does not measure vacuum, it measures hydraulic pressure?

A That's correct.

Q Can you identify Defendant's Exhibit 147?

A It's a data sheet dated 12-4-64 and they are

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pressure tests for a '67 Chevy station wagon.

Q Does this document reflect tests of a unit installed on a car or on the test stand?

A On a car.

Q That document is dated December 4, 1964?

A Yes.

Q Were you present at those road tests?

MR. BENBOW: Is Mr. Grand going to offer this document, your HOnor?

THE COURT: I don't know.

A I believe so, yes.

Q So that it is now your testimony that there were two different days of tests and you were present at both prior to December 21?

MR. BENBOW: Objection.

A No. I think I was only present at one.

Q Can you tell us which day's tests you were present at, those reflected as taking place on December 4 or those which are reflected as taking place on November 30?

A I am not really sure, but I -- I am not really sure.

MR. GRAND: Will you mark as Plaintiff's 148 that document.

THE COURT: Do you object to the offer of

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Plaintiff's 148?

MR. BENBOW: Is that what has been testified to as Defendant's 147?

MR. GRAND: Yes.

MR. BENBOW: It seems very confusing to me, your HOnor.

THE COURT: Yes, I would think so, too. Let's leave it Defendant's. You are offering a Defendant's exhibit.

MR. GRAND: All right. We are going to remove the Plaintiff's 148 for identification from a document designated as Defendant's 147. Should we mark it now as Defendant's 147?

THE COURT: Yes, and then offer it.

Mr. Benbow, are you going to object to this?

MR. BENBOW: Not at all, your Honor.

(Defendant's Exhibit 147 was received in evidence.)

Q Can you by comparing Plaintiff's and Defendant's 147 refresh your recollection as to which day of tests you were present at?

A No. I remember both Herman Sharp and Kalinowski being in the car. It's possible that I was there both times. I am really not sure.

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Q Can you tell us how many gauges, pressure gauges, were installed in the car on either or both of those occasions?

A It was one pressure gauge.

Q And that pressure gauge was designed to measure brake line pressure?

A Yes.

Q Now, can you tell us how many runs, if you recall, were made on the occasion or occasions when you were present?

THE COURT: Let me shorten it if I can. Those documents, do they each show the number of runs that occurred on the particular day?

THE WITNESS: Yes, they do.

THE COURT: All right.

MR. BENBOW: Would you like a copy, your HOnor?

THE COURT: No.

Q Can you tell us how the car equipped with the unit performed on the application of brakes as in a spiked stop?

MR. BENBOW: Which one are we talking about now?

MR. GRAND: I can't tell you.

THE COURT: Whichever day he was there.

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